CHOICE OF FINANCING METHOD WITH MARKET TIMING AND LIQUIDITY: EVIDENCE FROM AUSTRALIA

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DECLARATION OF ORIGINALITY

I certify that except where due acknowledgement has been made, this thesis is the original work of the author alone. The thesis has not been submitted previously, in whole or in part, to qualify for any other academic award. The content of thesis is the result of work which has been carried out since the official commencement date of approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

Signed:

Silvia Zia Islam

June 2009

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LIST OF CONFERENCE PAPERS BY THE CANDIDATE

RELEVANT TO THE THESIS

Islam, S., Heaney, R. 2007, 'Impact of market timing on Australian capital structure', 2007 AFAANZ Conference, http://www.afaanz.org/openconf/openconf.php

Islam, S., Heaney, R. 2009, 'Market timing or growth opportunities', European Financial Management Association (EFMA): Annual Meetings 2009 http://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2009-milan/confpap09.shtml

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ABSTRACT

The determinants of capital structure have become a question of increasing empirical importance. Changes in capital structure choice affect all firms, and therefore, managing external finance is a key concern in the area of corporate finance. Although theories have been developed to explain the determinants of capital structure, the issue of capital structure choice still remains a puzzle.

This thesis examines the capital structure choice of Australian firms with an emphasis on the impact of market timing and liquidity considering 1438 available firms for the period, 1997 to 2005. The relationship between capital structure and its determinants is the main focus of this thesis, with four empirical analyses. These analyses are all conducted within the Baker and Wurgler (2002) and Hovakimian (2006) models with both pooled ordinary least squares (OLS) and fixed effect panel analysis.

The theory of market timing introduced by Baker and Wurgler (2002) has received considerable attention in recent years. Baker and Wurgler (2002) contend that past market timing has a long lasting impact on capital structure and thus, capital structure is the cumulative outcome of the past attempts at equity market timing. This thesis examines the Baker and Wurgler (2002) argument in an Australian context. It is found that the variation in leverage was explained by the market-to-book ratio and the effect of market-to-book ratio was explained by equity issues as market timing theory implies. However, the results are sensitive to data sample choice with variation in the strength of the negative relationship observed between external finance weighted average market-to-book /past market value and leverage. This suggests that while market timing appears to affect capital structure choice, it does not support the hypothesis that past market timing decisions have a long lasting impact on Australian firm capital structure. Hovakimian (2006) questions the Baker and Wurgler (2002) conclusion about firm behavior and finds evidence that past market-to-book ratio has a significant impact on current financing decisions because it contains information about growth opportunities, not captured by the current market-to-book ratio. This thesis also examines the Hovakimian (2006) argument and finds evidence that the impact of past market value on leverage does not reflect past equity market timing,

rather it supports the argument of Hovakimian (2006) that, growth opportunities provide a reasonable explanation for the past market-to-book ratio effect for Australian firms. Analysis also focuses on broad industry differences. And it is found that there are significant differences between mining and non-mining firm in the determinants of capital structure.

Finally, the impact of liquidity on Australian capital structure choice is analyzed within the context of the Baker and Wurgler (2002) and Hovakimian (2006) models. It is found that liquidity is important to a firm's leverage choice. There is evidence that liquid firms tend to have lower leverage. Further, while liquidity has little effect on the sensitivity of leverage to market-to-book for Baker and Wurgler (2002) filtered data, a liquidity effect is evident in a broader set of four standard deviation filtered data. It is also found that greater liquidity is associated with less sensitivity of leverage to cash flows and that the asset tangibility relation with leverage is also sensitive to liquidity. Finally, there is evidence that more liquid firms are more sensitive in their tendency to revert to some long run leverage value.

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Corporate financing choices, or more specifically the determinants of capital structure choices, have been an issue of considerable discussion and debate over the last several decades. Most prior research on capital structure focused on the magnitudes of debt and equity, but the magnitude of debt-equity choice is still an open question (Myers 2001). However, several theories are developed in an attempt to explain the mix of securities and financing sources used by corporations to finance real investment. For example, the static trade-off theory says that the firm chooses a debt level where the benefits of tax shields offset financial distress costs (Fischer, Heinkel & Zechner 1989). The pecking order theory says that when internal funds are not adequate the firm will issue debt first and then equity (Myers 1984; Myers & Majluf 1984). The free cash flow theory suggests that increasing debt may increase value, despite increasing the risk of financial distress, when operating cash flows of firm significantly surpass the opportunities for profitable investment (Jensen 1986; Jensen & Meckling 1976).

An analysis of the debt-equity choice highlights the importance of determinants of capital structure, both at theoretical and an empirical level. From an empirical perspective, Baker and Wurgler (2002) suggest that choice of financing is hard to explain within the traditional theories. Traditional theories explain that firm capital structure is the result of either the trade-off between costs and benefits of debt and equity (Fischer, Heinkel & Zechner 1989; Jensen & Meckling 1976; Modigliani & Miller 1958; Ross 1977; Stulz 1990), or the result of the pecking order theory (Myers & Majluf 1984). Baker and Wurgler (2002) argue that market timing theory is the most natural explanation for the capital structure choice. This involves the exercise of issuing equity at a high price and repurchasing equity at a low price. According to Baker and Wurgler (2002), capital structure is the cumulative outcome of the past attempts to time the equity market.

Recent empirical research in capital structure has focused on regularities in the cross section of leverage to distinguish between various theories of financing policy. Both book and market leverage is related to profitability, book-to-market and firm size. Past book-to-market ratios have been shown to predict current capital structure. Firms appear to use external debt financing too conservatively, with the leverage of stable, profitable firms being particularly low. Even if firms have a target level of leverage, they move towards it slowly, at a "snail's pace" (Fama & French 2002). Thus, firms with low and high leverage react differently to external shocks. Existing explanations for these findings are related to various versions of the pecking order, trade-off or market timing theories. Each of these theories is supported by some evidence and challenged by other evidence (Strebulaev 2007).

1.2 MOTIVATION TO STUDY AUSTRALIAN CAPITAL STRUCTURE

Most of the empirical literature in the area of corporate finance has addressed the capital structure of US and UK based on market timing and other alternative theories. This body of literature is well represented by (Baker & Wurgler 2002; Bevan & Danbolt 2002; Fama & French 2002; Harris & Raviv 1991; Hovakimian 2006; Jalilvand & Harris 1984; Jensen & Meckling 1976; Kayhan & Titman 2007; Leary & Roberts 2005; Marsh 1982; Modigliani & Miller 1958; Myers & Majluf 1984; Rajan & Zingales 1995; Titman & Wessels 1988; Welch 2004). While some literature has emerged from Asia-Pacific region, for example (Allen 1991, 1993; Chiarella et al. 1992; Gatward & Sharpe 1996; Twite 2001), empirical evidence from this region remains sparse.

Previous literature draws attention to the general lack of research in the area of corporate finance in Australia highlighting the uniqueness of the markets and investment practices. Compared to the US and the UK, Australia has a different institutional environment, including a different dividend tax system, liquidation laws and regulatory environment. Further, unlike the UK and the US, Australia has a system whereby companies can raise their capital by issuing an accelerated rights issue that allows companies to raise capital from institutional investors more quickly (Booth et al 2001; Wilson 2009). These are some important features and they may

affect firm financing decisions. Thus, the investigation of the capital structure of Australian firms, one of the most established markets in the Asia-Pacific region, becomes both pertinent and essential. Given the importance of determinants of capital structure, this thesis attempts to explain the relationship between the theory of market timing, liquidity and Australian capital structure. Therefore, one major contribution of the study is that it explores the market timing theory with respect to Australian capital structure choice. Another important contribution of the analysis of financing choice and its determinants is analysis of differences between mining and non-mining firms. The final contribution is the analysis of transaction costs (liquidity) on Australian firm capital structure.

1.3 OBJECTIVES OF THE THESIS

There are four main objectives underlying this thesis, spread across four chapters. The first objective is to examine the Baker and Wurgler (2002) market timing theory with respect to Australian capital structure (Chapter 5). In this analysis tests are conducted to assess whether market timing has an impact on capital structure via the relationship between leverage and the market-to-book ratio. The change in leverage then decomposed into three components (net equity issues, newly retained earnings and growth in assets) to examine whether market-to-book effect comes from net equity issues as market timing theory implies. Finally, the relationship between external finance weighted average market-to-book (EFWAMB) [used as a proxy for past market-to-book ratio] and leverage is tested to address the question whether the effect of market-to-book ratio on leverage is persistent.

The second objective is to examine the arguments of Hovakimian (2006) who suggests that historical average or past market-to-book ratios have a significant effect on current financing decisions as these contain information about growth opportunities not captured by current market-to-book ratios (Chapter 6).

The third objective is to tests for broad industry effects (mining vs. non-mining firms) on capital structure modelling using both Baker and Wurgler (2002) and Hovakimian (2006) models (Chapter 7). Dummy variable based tests are relied

upon to test for significant differences between mining and non-mining firm coefficients.

The fourth and final objective is to examine the arguments of Leary and Roberts (2005) who suggest that transaction costs could affect capital structure changes over time (Chapter 8). Chapter 8 examines the role of liquidity on Australian capital structure by extending the Baker and Wurgler (2002) and Hovakimian (2006) model to assess the impact of liquidity on capital structure as well as on the various determinants of capital structure.

1.4 STRUCTURE OF THE THESIS

The thesis is structured in the following way. Chapter 2 surveys the most relevant literature in the area of corporate finance as well as the capital structure and its determinants. The statistical methodology used in the analysis is described in Chapter 3. Chapter 4 presents the data sets employed throughout the thesis. Chapter 5 introduces the Baker and Wurgler (2002) market timing theory in an Australian context and investigates the impact of this theory by addressing the question, whether the past market-to-book has long run or short run impact on Australian capital structure. Chapter 6 evaluates the argument of Hovakimian (2006) that past market-to-book contains information for growth opportunities. Chapter 7 applies the Baker and Wurgler (2002) and Hovakimian (2006) models in analysis of mining and non-mining firm capital structure choice. Chapter 8 explores the effect of liquidity by extending Baker and Wurgler (2002) and Hovakimian (2006) model. Chapter 9 concludes the thesis, summarising the major findings of the empirical analysis, emphasizing major contributions of this research to existing literature in finance and outlining future research directions.

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

Modigliani and Miller (1958) showed that a chief executive officer (CEO) can not create or destroy company value through his/her financing decision without the existence of market frictions. A voluminous literature provides insight into the fundamental characteristics of financing decisions through examinations of the determinants of capital structure. However, the magnitude of financing frictions is still an open question.

From an analytical perspective, empirical researchers develop an array of methods to determine the magnitude of financing frictions. For example, Modigliani and Miller's (1958) theory show that in a perfectly competitive market with no transaction costs, the costs of different types of capital do not vary independently so there is no gain in shifting from debt to equity or vice versa. While Modigliani and Miller's (1958) theory may be appropriate for a perfect capital market, in practice capital markets are not perfect and the literature shows that financing decisions do matter for the capital structure of a firm in an imperfect market. While the US literature is extensive (Baker & Wurgler 2002; Fama & French 2002; Fischer, Heinkel & Zechner 1989; Myers & Majluf 1984; Rajan & Zingales 1995; Wald 1939) there is also evidence of Australian research into the capital structure choice (Allen 1991, 1993; Gatward & Sharpe 1996; Twite 2001).

A further issue that has been addressed in several recent studies is whether or not external shocks have a persistent impact on the capital structure of a firm. This issue and determinants of capital structure has been the focus of investigation in a number of countries, including the US (Alti 2006; Baker & Wurgler 2002; Hovakimian 2006; Welch 2004); UK (Bevan & Danbolt 2002, 2004; Marsh 1982); and Netherland (Bie & Haan 2007).

The purpose of this chapter is to survey the existing literature in the area of capital structure. Section 2.2 discusses key empirical studies that form the principal

motivation for this thesis, while Section 2.3 outlines a number of empirical investigations that address the question of capital structure choice. Section 2.4 reviews the prior literature that motivates a study of the Australian capital structure. Literature addressing the liquidity effects is outlined in Section 2.5 and the chapter is concluded with Section 2.6.

2.2 KEY EMIPIRICAL PAPERS

The empirical evidence presented in this thesis is motivated by several key studies. These studies include Baker and Wurgler (2002); Hovakimian (2006); Leary and Roberts (2005); Welch (2004).

2.2.1 Baker and Wurgler (2002)

Recent studies of Baker and Wurgler (2002) suggest that choice of financing is hard to explain within the traditional theories. Yet, it is argued that equity market timing is an important aspect of corporate financial decision-making. This involves the exercise of issuing equity at a high price and repurchasing equity at a low price (Baker & Wurgler 2002; Bie & Haan 2007; Elliott, Koeter-Kant & Warr 2007; Kayhan & Titman 2007) and so management beliefs about the value of the company relative to its price may influence real corporate financial policy (Baker & Wurgler 2002).

In the Baker and Wurgler (2002) study, the whole sample of 2,839 observations on firms at the first fiscal year end after IPO was collected from 1968 to 1999. They analyse the capital structure choice of a firm using the IPO date as the first date for data collection because IPO listing is an important financing decision point for many corporations. Their primary analysis was based on cross sectional regressions of leverage on market-to-book ratio and a set of control variables (Fama & French 2002; Rajan & Zingales 1995). They find that there is a strong negative relationship between market-to-book and change in leverage, which suggests the existence of market timing.

Then Baker and Wurgler (2002) decompose the change in leverage into three components: net equity issues, newly retained earnings and asset growth to focus on

the actual source of the effect. And they found that the effect of market-to-book on leverage comes through net equity issues as the market timing theory implies. Further, in their analysis, Baker and Wurgler (2002) show that market timing has a very large and persistent effect on the capital structure of US firms based on their findings of statistically significant inverse relationship between external finance weighted average market-to-book and leverage. They find that low-leverage firms tend to raise equity when their valuations are high and conversely high-leverage firms tend to raise debt when their valuations are low.

The authors argue that firms do not participate in capital structure rebalancing subsequent to issuing equity. They show that historical/past market-to-book ratios have a statistically significant impact on current capital structure (Bie & Haan 2007; Faulkender 2005). Further, the authors claim that the persistent impact of past market-to-book on leverage is not due to the trade-off or pecking order theories but to equity market timing. As a result, capital structure is the cumulative outcome of past attempts at equity market timing (Baker & Wurgler 2002; Bie & Haan 2007; Huang & Ritter 2005). Baker and Wurgler's (2002) empirical results are also supported by a survey of US corporate executives (Graham & Harvey 2001).

2.2.2 Hovakimian (2006)

Hovakimian (2006) in his recent study questions Baker and Wurgler's (2002) conclusion that capital structure is the cumulative outcome of past attempts at equity market timing and finds evidence that the effect of past market-to-book ratio on leverage is not due to equity market timing rather it reflects growth opportunities.

Hovakimian (2006) develops new evidence to re-evaluate the main conclusions of Baker and Wurgler (2002) and finds convincing evidence that the effects of equity transactions on capital structure are short lived, implying that equity market timing is unlikely to be responsible for significant long lasting effects of past market-to-book ratios on leverage. Rather, his research tests the alternative hypothesis that the historical average market-to-book ratio contains information about firm growth opportunities that induce significant negative effects on current capital

structure and current investment decisions. And, this relationship is not captured by the current market-to-book ratio.

Since Baker and Wurgler (2002) found evidence for the theory of market timing in US firms, this aspect of empirical literature has expanded. However, there is no research completed to test the theory of market timing using Australian firms. Therefore, this thesis explores the Baker and Wurgler (2002) market timing theory and Hovakimian (2006) arguments using Australian evidence in chapters 5, 6 and 7 respectively.

2.2.3 Welch (2004)

Recent studies of capital structure policy reach similar conclusions to Hovakimian (Welch 2004). Welch studied the influence of the stock price changes on the capital structure of all publicly traded US corporations from the period, 1962 to 2000. In his study he decomposes the capital structure changes into effects caused by net corporate issues and into effects caused by stock returns.

Welch (2004) shows that once dividend payments are excluded from equity issues the effect of timing patterns disappear. He argues that equity returns are the primary determinants of debt ratios. Welch (2004) and Huang and Ritter (2005) both find that stock returns or equity price shocks and aggregate measures of market valuation have a long run impact on capital structure rather than market timing, as stock price changes affect the choice of financing. In the inertia theory of Welch (2004), he predicts that due to changes in the market value of equity over the period from t to t + k, the changes in leverage occur with the start-of-period leverage ratio. Finally Welch (2004) concludes that firms fail to rebalance their capital structures in response to shocks to the market value even within a time horizon as long as five years. Thus he argues that stock return is the fundamental determinant of capital structure.

2.2.4 Leary and Roberts (2005)

Most empirical studies assume that the capital structure rebalancing is cost free and so ignore liquidity. Firms can rebalance their capital structure frequently to maintain

optimum leverage in liquid markets. But, Leary and Roberts (2005) show that introducing transaction costs including the costs of illiquidity can induce the firms not to respond immediately to capital structure shocks. If the transaction costs exceed the benefits, firms may wait. Thus a period of financing inactivity could occur because of these costs. This thesis use measures of liquidity to capture the transaction costs.

Leary and Roberts (2005) in their recent study of capital structure dynamics reject the market timing argument and show that the persistence of shocks to leverage is related to transaction costs, though firms still actively rebalance their capital structure. This result induces them to re-examine the conclusions of Baker and Wurgler (2002) and Welch (2004) and they find that the persistence effect of market-to-book and stock prices noted in Baker and Wurgler's and Welch's empirical work is more likely due to transaction costs than market timing. Specifically they find that decreasing transaction costs significantly weakens the effect of market timing on leverage.

It is argued that shocks to equity valuation persist for varying periods of time (Elliott, Koeter-Kant & Warr 2007; Leary & Roberts 2005). Leary and Roberts (2005) argue that firms take part in rebalancing in response to equity issuance and equity price shocks within two to four years and so the effect of equity issues on leverage is not long lasting. The authors conclude that their results favour dynamic rebalancing, supporting the persistent effect of past market-to-book ratio on leverage rather than market timing. The study use measures of liquidity to proxy for transaction costs associated with issue of equity in the analysis that follows.

2.3 OTHER SIGNIFICANT EMPIRICAL STUDIES

There is a substantial literature at both a theoretical and an empirical level dealing with the determinants of capital structure. Inevitably analysis of optimal capital structure theory begins with Modigliani and Miller (1958) who assumed perfect and frictionless capital markets, in which financial innovation would quickly extinguish any deviation from their predicted equilibrium. But in practice capital markets are imperfect and the literature shows that in this case capital structure choice can matter

(Fischer, Heinkel & Zechner 1989; Jensen 1986; Jensen & Meckling 1976; Myers 1984; Myers & Majluf 1984).

The following studies are closely related to the study included in Chapters 5 and 6 of this thesis. The determinants of capital structure are a well-documented phenomenon in the finance literature yet, it is still hard to explain. Jensen and Meckling (1976) and Jensen (1986) develop a model of agency costs which predict that a manager will use excess earnings from profitable investments (free cash flow) to finance low return projects or perquisites. This theory helps to explain the benefits of debt along with the costs of debt because debt helps to decrease these free cash flows. This is because issuing debt will force managers to pay out the excess cash as interest payments. Returns from assets and the size of profitable investments determine a firm's free cash flow (Fama & French 2002). The free cash flow argument predicts that leverage and dividends are positively related. Firms with more profit have more leverage and payout more dividends. On the other hand, firms with more investment opportunities have less leverage and payout less dividends.

Fisher, Heinkel and Zechner (1989) developed a model of dynamic capital structure including recapitalization costs. Their theory is based on the analysis of the traditional tax shields and bankruptcy costs[1]. It is demonstrated that any debt ratios within the transaction cost boundaries can be optimal so that firms tend to change their capital structure over time in the presence of transaction costs. Fisher, Heinkel and Zechner's (1989) dynamic trade-off model of capital structure shows that restructuring costs can make a difference to a firm's debt to equity ratio over time. This theory also predicts that a firm will use debt up to an optimal level where the possible net present value (NPV) of bankruptcy costs are offset by the marginal value of tax shields (Myers 2001).

Myers (1984) introduces the pecking order theory of capital structure which depicts the manager as having superior knowledge about the firm's future prospects. As a result of information asymmetry costs, firms prefer internal funds, then safe debt, risky debt and finally they issue equity when considering financing a new project

[1] Fama and French (2002) suggest that the trade-off model is a mixture of bankruptcy costs (firms are forced toward less target leverage) and agency costs (firms are forced toward more target leverage) and that these effects drive leverage and dividends, though the results of analysis should not change much.

(Fama & French 2002). It is assumed that if managers have more information than the market they will act in favour of existing shareholders, which creates the problem of information asymmetry between owners and outside investors (Myers 1984). Myers also assumes that the existing shareholders are indifferent and are not interested in rebalancing their portfolio. This model predicts that firms will choose debt over equity if they need external finance. Myers (1984) modified his theory using Myers and Majluf (1984) where they show that by using internal information managers issue risky securities when the price is high. Investors react to this information asymmetry by reducing the firm's share price when the firm announces a new issue of shares. Thus managers tend to use retained earnings for financing projects to avoid this asymmetric information problem.

Marsh (1982), in his analysis, considers 748 security issues from UK companies to examine their selection between debt and equity at a given point in time. His study finds evidence that companies try to maintain their long-term target leverage ratios while choosing between debt and equity. However, in the short run leverage may diverge in response to timing considerations and market conditions. Overall, the Marsh (1982) results are consistent with the perception that target leverage itself is a function of company size, bankruptcy risk, and asset composition.

In 1988, Titman and Wessels extend the previous empirical work by analysing the explanatory power of some of the recent theories of optimal capital structure. Titman and Wessels (1988) introduced a factor-analytic technique in their study to estimate the impact of unobservable attributes on capital structure choice. Their results find evidence that firms that have power to impose high costs on their customers, suppliers and workers at time of liquidation, have lower debt ratios. Their results also indicate that transaction costs may be an important determinant of capital structure choice.

Harris and Raviv (1991) in their review of the literature discuss the theories of capital structure based on agency costs, asymmetric information, product/input market interactions, and corporate control considerations though these discussions excludes tax based theories. And relative to their interpretation trade-off theory relates to taxes, pecking order theory relates to information asymmetry and free cash flow theory relates to agency problem (Myers 2001).

It has been observed that leverage is related to firm size, growth opportunities, liquidation, and value of assets and this is consistent with the predictions of trade-off theories (Chang & Dasgupta 2003). The studies that report the importance of target leverage as a determinant of debt/equity choice are also supportive of the trade-off hypothesis (Jalilvand & Harris 1984; Marsh 1982). On the other hand, the pecking order model generally outperforms the trade-off model while explaining the time series variation in leverage (Shyam-Sunder & Myers 1999). Shyam-Sunder and Myers (1999) introduce a new test of the Pecking Order Model. They test traditional capital structure models against the pecking order model of corporate financing. Their study shows that a simple pecking order model can outperform the static trade-off model while explaining the time-series variation in target leverage. Yet, in a comment on the Shyam-Sunder and Myers (1999) study, Chrinko and Singha (2000) show that Shyam-Sunder and Myers (1999) evaluate neither the pecking order nor static trade-off model. Chrinko and Singha (2000) suggest that alternative tests are needed to identify the determinants of capital structure that can better distinguish among competing hypotheses.

Fama and French (2002) are the first to test the classic trade-off theory and pecking order predictions jointly with respect to dividends and leverage. The authors find that on many occasions both models share predictions about dividends and leverage. For example, they show that the two models predict that when controlling for other effects, more profitable firms have higher dividend payout, and firms with more investments have lower payouts. But there is one major issue where both models conflict the mean reversion of leverage.

A more recent study of the capital structure decision questions the long run impact of market timing and its economic significance (Alti 2006; Flannery & Rangan 2006). Alti (2006) argues that initial public offering (IPO) is a more robust measure of market timing. In his analysis, he shows that market timers, identified as firms that go public when the market is hot, issue more equity than cold-market firms do. As a result, hot-market firms experience greater declines in their leverage ratios in the IPO year. However, these firms start issuing more debt and less equity immediately after the IPO year which results in significant increase in the leverage ratios of hot-market

firms. Thus, the results of Alti (2006) suggest that market timing is an important determinant of capital structure in the short run, but its long run impact is limited.

Further, by decomposing Baker and Wurgler's (2002) market timing measure into short term (to capture yearly timing of financing activities) and long term components (to capture persistence in market-to-book ratios) Kayhan and Titman (2007) find that the persistence in market-to-book ratios drive the results reported in Baker and Wurgler (2002) rather than timing. Kayhan and Titman's (2007) result is consistent with the dynamic capital structure models which show that in presence of reasonable levels of transactions costs and traditional costs and benefits of debt financing, the leverage ratio varies over a relatively large range (Fischer, Heinkel & Zechner 1989; Titman & Tsyplakov 2005).

Hovakimian, Opler and Titman (2001) employ a two stage estimation procedure that allows them to test whether firms adjust toward a target debt ratio when they adjust their capital structures. Their test documents that as firms change over time, their target debt ratio also changes. Hovakimian (2004) extends the previous research (Hovakimian, Opler & Titman 2001) and finds evidence that firms with target debt ratios can engage in timing the equity market as only debt reductions or debt issues have significant long lasting impact on capital structure.

The market timing theory can be reconciled with the pecking order theory, by assuming that adverse selection costs are time-varying, as are stock prices. For example, it is emphasized that if firms can decide when to issue equity, they will do so in periods when asymmetric information is expected to be relatively unimportant (Choe, Masulis & Nanda 1989; Korajczyk, Lucas & McDonald 1992).

The use of market-to-book ratio to test market timing is difficult as it may attract a number of interpretations which include asymmetric information, growth opportunities and debt overhang problems. As an alternative valuation measure, Elliot, Koeter-Kent and Warr (2007) use the residual income model to measure the effect of the misevaluation of equity and the impact of market timing on corporate financing decisions. The authors find that firms issue equity to fund the deficit when their equity is overvalued by the market. Overall, their results provide evidence consistent with the Baker and Wurgler (2002) market timing theory of capital structure.

Other researchers, such as Frank and Goyal (2003) re-examine the Shyam-Sunder and Myers (1999) approach and find that net equity issues, rather than debt issues, more closely track the financing deficit. Faulkender (2005) examines whether firms are timing the market or hedging in the case of selecting the interest rate exposure created by new debt issuances. His results indicate that the interest rate exposure is largely driven by the slope of the yield curve.

Finally, Strebulaev (2007) investigates the empirical implications of capital structure and shows that the reaction to external economic shocks varies significantly between firms with high leverage and firms with low leverage (Baker & Wurgler 2002; Fama & French 2002; Graham & Harvey 2001; Hovakimian, Opler & Titman 2001; Leary & Roberts 2005; Titman & Wessels 1988; Welch 2004). The author argues that firms do not adjust their capital structure frequently and thus in a dynamic economy there is a difference between optimum leverage and leverage of firms at time of readjustment. He argues that there is need to rethink the tests that are conducted to explain the capital structure.

2.4 MOTIVATION FOR INVESTIGATING THE AUSTRALIAN MARKET

As discussed, much of the empirical literature in the area of corporate capital structure has addressed firm financing frictions (Baker & Wurgler 2002; Fama & French 2002; Fischer, Heinkel & Zechner 1989; Harris & Raviv 1991; Hovakimian, Opler & Titman 2001; Leary & Roberts 2005; Modigliani & Miller 1958; Myers 1984, 2001; Titman & Wessels 1988; Welch 2004). While a literature has emerged from Australia, for example Allen (1991, 1993); Gatward and Sharpe (1996); and Twite (2001), empirical evidence from this country remains sparse. Further, the market timing hypothesis has been more popular in the business press than in the finance literature in Australia. For instance, on August 19 2009, business journalist, Sue Mitchell reported in the Australian Financial Review under the headline, “It all comes down to good timing” that “Amcor’s $2.44 billion purchase of Rio Tinto’s Alcan Packaging business has been timed perfectly by Amcor chief executive Ken Mackenzie. Asset values are significantly lower than the past few years, but it’s also a good time to raise equity….”.

Allen (1991) investigates the broad determinants of Australian capital structure by examining 48 listed Australian company financial managers' perceptions. His results are consistent with Donaldson's (1984) findings which appear to follow the pecking order theory when external finance is needed. Further, Allen investigates this theory based on a sample of mature Australian listed companies (Allen 1993). The pecking order theory suggests that there should be a negative relationship in cross-section between corporate profitability and debt ratios and Allen finds evidence to support the existence of the pecking order hypothesis in Australian firms.

Gatward and Sharpe (1996) examine the financial structure decisions of Australian firms assuming the existence of dynamic capital structure choice. A new methodological approach is used in the study of interrelated equity and debt financing decisions and the study reveals that capital structure decisions are interrelated. Gatward and Sharpe (1996) also find evidence of interdependence of investment and financing decisions and slow adjustment toward a target capital structure. Thus Australian research supports both the pecking order theory and the optimal capital structure theory.

In a recent study, Twite (2001) introduces the impact of the dividend imputation tax system while examining corporate capital structure in Australia. In his analysis, he shows that, the introduction of the system significantly changes Australian capital structure around the change in the tax framework. Further, the results show: (i) a decline in the aggregate levels of total debt; (ii) to an extent, the decline in the level of debt is determined by the firm's effective tax rate; (iii) the proportion of capital raised through retained earnings decreased and (iv) subsequent to the introduction of dividend imputation, the proportion of capital raised through new equity issues increased. Similarly, Pattenden (Pattenden 2006) investigates the determinants of capital structure based on the tax incentives for debt using a Bayesian selection method. Her analysis demonstrates that tax coefficients are insignificant with the introduction of dividend imputation tax system.

A study by Chiarella et al. (1992) regarding the determinants of corporate capital structure using 226 Australian companies, supports the theory proposed by DeAngelo and Masulis (1980) which shows that firms enjoy the benefit of tax deductions without the burden of debt. The Chiarella et al. (1992) results are also

supportive of the pecking order theory as well as being consistent with the findings of Titman and Wessels (1988) which find no support for growth opportunities and collateral value effects.

Cassar and Holmes (2003) investigate the determinants of capital structure and use of financing for small and medium sized (SME) enterprises of Australia. Cassar and Holmes (2003) identified five important determinants of capital structure which are asset structure, size, profitability, growth and risk. And, their results generally support the static trade-off and pecking order theories.

There is no study that examines the capital structure of mining and non-mining firms or tests for significant difference in mining and non-mining firm capital structure decisions. However, literature based on IPO with mining and non-mining firm provides exception (Da Silva Rosa, Velayuthen & Walter 2003; Da Silvia Rosa 1995; How 2000; Lee, Taylor & Walter 1996). The focus of study in Chapter 7 is to test for significant difference in mining and non-mining firm capital structure determinants. As such it is important to discuss briefly the other areas of research that focus on mining and non-mining firms in Australia.

In an early study it is reported that for the period 1958 to 1979, mining equities appear to be considerably riskier than industrial equities and that risk does not appear to be diversifiable (Ball & Brown 1980). Lee, Taylor and Walter (1996) examine 266 industrial IPO firms and find evidence that these IPOs perform poorly in the market. How (2001) examines the initial and long-run performance of 130 Australian mining IPOs and finds that the average underpricing of mining IPOs is significantly higher for industrial firms.

In contrast with previous studies, in particular for Australian industrial IPOs (Lee, Taylor & Walter 1996), How (2001) finds that mining IPOs in Australia do not significantly underperforms the market in the long-run in general. In a recent study of Australian IPOs, Da Silva Rosa, Velayuthen and Walter (2003), find no significant difference in the underpricing of venture capital (VC) and non-VC backed IPOs and also document that they do not perform poorly in the after-market. Clements and Johnson (2000) in their study of the mineral industry and employment of Western Australia in particular, show that, mineral industry alone directly contributes around 20% of the state gross product and this sector is the largest employer compared to

other industrial firms. It has also been argued that when issuing companies are separated into sub-samples based on industry classification abnormal returns vary significantly among industrial non-financial, financial and mining companies (Balachandran & Tanner October, 2001).

2.5 CAPITAL STRUCTURE AND LIQUIDITY

It is now well established that transaction costs including illiquidity are an important factor in determining the debt equity choice of a firm (Lo, Mamaysky & Wang 2001). It has been argued that liquidity is considered to be among the key elements of many investment plans and financial instruments (Amihud & Mendelson 1986a). However, despite its growing importance in practice, the role of liquidity on capital structure in academic research is limited. And this is because estimates of liquidity are difficult and expensive to calculate (Lesmond, Ogden & Trzcinka 1999).

Several proxies have been used to estimate the transaction costs in prior literature. Popular proxies for transaction costs include the bid-ask spread and trading volume. Generally, the argument is that higher transaction costs lead to higher expected returns and lower trading volume, but the literatures disagrees on the relative magnitudes of these effects. Amihud and Mandelson (1986) find that the expected returns are highly sensitive to changes in transaction costs. In their study, Amihud and Mandelson (1986) analyse the effect of bid-ask spread on asset pricing. The authors develop a model which predicts that investors trade assets with different expected holding periods and different relative spreads. Their study suggests that asset returns are an increasing and concave function of the relative spread. Finally, their results show that if firm size is included in the model as an explanatory variable, the bid-ask spread effect persists. Overall, Amihud and Mandelson (1986) demonstrate that market micro structure is an important determining factor of for stock returns. Other researchers also use these proxies for transaction costs (Barclay, Kandel & Marx 1998; Bollen, Smith & Whaley 2004; Chang et al. 2002; Kan & Chen 1995).

Barclay, Kandel and Marx (1998) in their study, examine the effects of changes in transaction costs (proxies by bid-ask spread) on stock prices and trading volumes. To estimate the sensitivity of price and volume of changes in transaction

costs, the authors use an event-study approach. Prior literature on transaction costs suggests that if everything holds constant, an increase in a stock's bid-ask spread will increase the stock's holding period as well as future expected returns and thus reduce the trading volume. Their results however, find that the changes in transaction costs (bid-ask spread) do not have an economically significant effect on stock prices which implies that the effect of transaction costs on the liquidity premium is insignificant. Their results are not consistent with Amihud and Mandelson (1986), but consistent with Constantinides (1986) Kan and Chen (1995), and Vayanos (1998) who show that transaction costs play a minor role in the determination of expected returns on security markets.

On the other hand, Datar, Naik and Radcliffe (1998) examine the effect of liquidity on stock returns using an alternative test to that of Amihud and Mandelson (1986) and use turnover rate as a proxy for liquidity. Turnover rate is defined as the number of shares traded as a fraction of number of shares outstanding. Their result shows that liquidity effects persist after controlling for well known determinants of stock returns, such as, book to market, firm size and firm beta. Overall, Datar, Naik and Radcliffe (1998) find strong support for Amihud and Mandelson (1986) model by showing a significant relationship between stock returns and liquidity.

Lesmond, Ogden and Trzcinka (1999) introduce a new method of estimating transaction costs which is known as the zero-return measure. With this method, transaction costs are estimated through the incidence of zero returns. Their results show that zero returns are that the frequency of zero returns is negatively correlated with firm size and positively correlated with other measures of transaction costs. Basically, their model proposes an alternative proxy for transaction costs which requires only the time series of daily security returns and is easy to calculate.

Firms try to maintain an optimum capital structure by balancing the losses and profits associated with the different levels of financial leverage. However, recently researchers have sought evidence of whether firms actually use dynamic rebalancing. Leary and Roberts (2005) show that firms tend to make capital structure changes in clusters. Such a chronological pattern of financing choice is also evident in a recent empirical study of Altinkilic and Hansen (2000) where it is documented that the

issuance cost of debt and equity consists of both fixed and convex variable cost components.

Leary and Roberts (2005) rebalancing evidence is also consistent with the aspects of the dynamic trade-off model of Fisher, Heinkel and Zechner (1989) and the adjusted model of Myers and Majluf (1984) and Myers (1984). In addition to that they find that firms with large cash balances and greater profitability are reluctant to use external finance compared to firms with large expected investment expenses. Thus, the results suggest that both bankruptcy costs and information assymetry costs are important determinants of capital structure.

The survey results of Graham and Harvey (2001) shows that the costs and benefits of debt financing are the most important consideration for managers. Further, Jalilvand and Harris (1984) and Fama and French (2002) use a partial adjustment model to test for mean reversion in leverage. These previous studies support the recent evidence documented by Leary and Roberts (2005) who also argued that adverse selection costs may be an important element in the financing decision even though firms may follow a dynamic rebalancing strategy.

Emerging markets are experiencing rapid growth and the importance of estimating liquidity in emerging markets is emphasized by Bekaert et al. (2003). Lesmond (2005) in his recent study tests five different liquidity measures against the quoted bid-ask spread to asses each measure's efficacy in estimating the underlying liquidity of 31 emerging markets. The five common liquidity measures that are considered for this study are (i) Roll's measure (Roll 1984); (ii) the Amivest measure (Amihud et al. 1997); (iii) Amihud's measure (Amihud 2002); (iv) turnover; and (v) the LOT measure (Lesmond et al. 1999). Lesmond (2005) documents that liquidity costs vary considerably across emerging markets. Overall, his analysis specifies that each measure has strengths and weaknesses while used to evaluate cross-country liquidity. However, the variation of liquidity is best estimated using the price based models of Lesmond et al. (1999) (zero-return measure) and Roll (1984).

In recent years, researchers have revealed a variety of unusual phenomena in light of the traditional static trade-off theory. Hennessey and Whited (2005) in their study, seek evidence of whether these phenomena are indeed unusual. They develop a dynamic trade-off model with endogenous choice of leverage, distributions and real

investment. Their study shows that the dynamic trade-off model can explain the stylized facts of capital structure discussed in previous studies (Baker & Wurgler 2002; Myers & Majluf 1984). Theoretically and by model simulation, their analysis show that there is no target leverage ratio, firms can save or be heavily levered. Overall, their theory is inconsistent with other studies of dynamic trade-off because the Hennessey and Whited (2005) model shows that firms make leverage decisions jointly with current investment decisions and this joint decision depends strongly on current and future financing margins.

Furthermore, empirical researchers have employed an array of methods to gauge the magnitude of financing frictions (Altinkilic & Hansen 2000; Andrade & Kaplan 1998; Asquith & Mullins 1986). Hennessey and Whited (2007) extend their previous study (Hennesy & Whited 2005) to estimate external financing costs using simulated methods of moments (SMM). They obtain a unique result which shows that there are large differences between the external costs for large and small firms. When large firms need external finance they behave as if they face small indirect costs of external finance. On the other hand, small firm behave as if they face large indirect costs of external finance.

Finally, while Lesmond, Ogden, and Trzcinka (1999), Lesmond (2004) and Hasbrouck (2006) test whether some of the available liquidity proxies are related to liquidity benchmarks, they construct liquidity proxies on an annual or quarterly basis. The vast majority of the literature employs monthly (or finer) data for liquidity proxies. Given the limited number of liquidity proxies previously tested, the limited set of liquidity benchmarks used in the literature, and the absence of monthly proxies, it is not surprising that there are conflicting views about which measure is better. A most recent study addressing this gap in the literature provide a comprehensive study of liquidity measures (Goyenko, Holden & Trzcinka 2009). In this study, they examine widely used proxies for liquidity along with three new proxies for effective and realized spread, and nine new proxies for price impact. The authors find a close association between many of the measures and actual transactions costs. Some measures are able to precisely estimate the magnitude of effective and realized spreads and many are highly correlated with both spreads and price impact. In

summary, their results indicate that researchers should choose a measure as a proxy for liquidity, based on what they want to measure.

The role of liquidity is rapidly growing in empirical asset pricing, market efficiency and corporate finance over the past few years. The common assumption behind most of the prior studies is that the available liquidity proxies capture the transaction costs of market participants which play an important role in empirical finance. However, despite growing concern, the role of liquidity in Australian capital markets is limited. Therefore, Chapter 8 of the thesis narrows this gap by examining the effects of transaction costs (liquidity) on Australian capital structure by extending the Baker and Wurgler (2002) and Hovakimian (2006) models. In this thesis, the author considers two widely used proxies for liquidity that is bid-ask spread and trading volume along with zero-return, a new proxy for price impact proposed by Lesmond, Ogden and Trzcinka (1999).

2.6 CHAPTER SUMMARY

This chapter has outlined some of the major studies that have been published in the area of corporate leverage focusing on the theories and determinants of capital structure. The general lack of evidence for capital structure choice in studies conducted in many of the world's markets, has led to the implementation of various approaches in a bid to both identify and quantify the determinants of leverage. However, prior literature draws attention to the general lack of research in the area of capital structure in Australia. This thesis presents and analyses some of these issues in the investigation of Australian capital structure. As such, this thesis attempts to fill some of the gap in an understanding of Australian capital structure choice.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the methodology used in this thesis. Panel data analysis with pooled ordinary least square estimates (OLS) and with fixed effect specification are used in the analysis reported in following chapters. A Wald-coefficient test is employed in Chapter 7 in tests for variation between mining and non-mining firms. Finally, interaction terms are used to capture the impact of transaction costs/liquidity on corporate leverage.

3.2 HYPOTHESES

In Australia, few studies are conducted addressing the issue of market timing and research into the impact of transaction costs on capital structure is also limited. This thesis consists of four individual studies.

The first study examines Baker and Wurgler's (2002) market timing theory and its impact on capital structure, using Australian data.

Hypothesis 1:

Null **:** Capital structure of a firm is uncorrelated with past market-to-book.
Alternative **:** Capital structure of a firm is correlated with past market-to-book.

The second study examines the arguments of Hovakimian (2006) who suggest that historical average market-to-book ratios have significant effect on current financing decisions as these contain information about growth opportunities not captured by current market-to-book ratios.

Hypothesis 2:

Null **:** Past market-to-book is not related to growth opportunities.

Alternative **:** Past market-to-book is related to growth opportunities

The third study tests for broad industry effects (mining vs. non-mining firms) on capital structure modelling using both Baker and Wurgler (2002) and Hovakimian (2006) models. Dummy variable tests are relied upon to test for significant differences between mining and non-mining firms.

Hypothesis 3:

Null **:** Mining and non**-**mining firm results do not differ significantly.

Alternative **:** The determinants of leverage across mining and non**-**mining firm results differ significantly.

The fourth study examines the arguments of Leary and Roberts (2005) who suggest that transaction costs affect capital structure changes over time.

Hypothesis 4:

Null **:** Transaction costs are unrelated with capital structure.

Alternate **:** The lower the level of transaction costs (higher the liquidity) the more closely a firm's capital structure follows its long-term target.

3.3 PANEL DATA ANALYSIS

The term "panel data" refers to the pooling of observations on a cross-section of firms, households, countries etc over several time periods (Brüderl 2005). Gujarati (2003) says that any cross sectional unit such as firms or countries can be surveyed over time. The motivation behind using the panel data for analysis is because of possible information and estimation efficiency gains (Gujarati 2003). Further, panel data analysis can control for individual firm unobserved heterogeneity.

3.3.1 Pooled ordinary least square estimates (OLS) with panel data

Ordinary least squares estimation (OLS) is extensively used for multivariate regression analysis because it is a simple method with intuitively appealing properties. When this is used to estimate pooled data models, it is referred to as pooled-OLS. Using OLS estimation the regression function is as follows:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \tag{3.1}$$

Here, Y_{it} is the dependent variable that represents leverage in the study. X_{it} is the independent variable matrix. This represents a matrix of explanatory variables including market-to-book; firm size etc. α is the intercept and β is the vector of slope coefficients.

3.3.2 Pooled OLS fixed effect estimator with panel data

The fixed effect method (FEM) is a more general approach to eliminate omitted variable bias in the multivariate regression analysis that could result from estimation based on the simple OLS model. The fixed effect method assumes that the estimated (slope) coefficients do not vary across companies or over time. In this case the coefficients are time invariant and cross section invariant. Model (3.1) is expanded as follows:

$$Y_{it} = \alpha_i + \alpha_t + \beta' X_{it} + \varepsilon_{it} \tag{3.2}$$

The fixed effect model given in (3.2), assumes that the estimated slope coefficients (β') do not vary across companies or over time though dummy variable coefficients are estimated for each company α_i and for each year α_t to capture unobserved heterogeneity in the data.

3.4 MODELS

In this section, the study discusses the model used in analysis and provides definitions for all the explanatory variables used to proxy for market timing, growth opportunities, industry effects as well as transaction costs estimates.

3.4.1 Model for market timing: Determinants of changes in leverage

To document the relationship between market-to-book and annual changes in leverage the study uses the pooled OLS model below (dropped i for simplicity):

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t \quad (3.3)$$

Here, book value of leverage $\left(D/A\right)$, defined as book debt to assets where book debt (D) is the total assets minus book equity. Book equity (E) is defined as total assets less total liabilities. The most important variable and main focus of the model is on market-to-book ratio which is used as a proxy for market timing $\left(M/B\right)$. It is defined as assets minus book equity plus market equity all divided by total assets where market value of equity ($E^{/}$) is, ordinary share price × shares outstanding. It is assumed that market-to-book may be related to investment opportunities, growth opportunities and market mispricing. Firms with high market-to-book ratio tend to issue equity or to use internal funds that lead to debt reduction. Therefore, an inverse relationship between leverage and market-to-book is postulated.

Three additional control variables are included in the model. Fixed asset tangibility $\left(PPE/A\right)$, is defined as net property, plant and equipment divided by total assets. Agency theory suggests that firms with high leverage are reluctant to invest and thus, firms want to transfer wealth away from debt holders to equity holders. As a result, lenders require collateral because the use of secured debt can help ease this problem. Hence, firms unable to provide collateral have to pay higher interest or be forced to issue equity instead of debt (Scott 1977). Therefore, a positive relationship between leverage and asset tangibility is anticipated. Profitability $\left(EBITDA/A\right)$ is defined as earnings before interest, taxes and depreciation divided by total assets. The pecking order theory suggests that firms prefer to use internal funds because of the informational asymmetry between managers and outside investors. In addition, profitable firms tend to reduce external equity in order to minimise the impact on

existing ownership. Thus, an inverse relationship between leverage and profitability is expected. Firm size $(Log(s))$, is defined as the natural logarithm of total revenue. As large firms are less likely to face financial distress, size is expected to have a positive impact on leverage. Finally, the last control variable is lagged leverage, which is included in the model to capture time series effects and to be consistent with Baker and Wurgler (2002). The last variable, lagged leverage often enters the analysis with a negative sign and this is consistent with the tendency for leverage to revert toward a long run equilibrium value over time. Table 3.1 summarises the relationships postulated by the theory between each explanatory variable and leverage.

The change in leverage is then decomposed into three components: net equity issues, newly retained earnings and growth in assets, following Baker and Wurgler (2002). This is used to focus on the actual sources of change (net equity issues, retained earnings and asset growth). The decomposition takes the following form.[2]

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left[\left(\frac{E}{A}\right)_t - \left(\frac{E}{A}\right)_{t-1}\right] = -\left(\frac{e}{A}\right)_t - \left(\frac{\Delta RE}{A}\right)_t - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] \tag{3.4}$$

Here in (3.4), net equity issues are defined as the change in book equity minus the change in balance sheet retained earnings divided by total assets and denoted as $\left[-\left(\frac{e}{A}\right)_t\right]$. Newly retained earnings is defined as the change in retained earnings

[2] Derivation of this decomposition are:

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e}{A}\right)_t - \left(\frac{\Delta RE}{A}\right)_t - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right]$$

$$= -\left(\frac{E_t - E_{t-1} - RE_t + RE_{t-1}}{A_t}\right) - \left(\frac{RE_t - RE_{t-1}}{A_t}\right) - \left(\frac{E_{t-1}}{A_t} + \frac{E_{t-1}}{A_{t-1}}\right)$$

$$= -\frac{E_t - E_{t-1}}{A_t} + \frac{RE_t - RE_{t-1}}{A_t} - \frac{RE_t - RE_{t-1}}{A_t} - \frac{E_{t-1}}{A_t} + \frac{E_{t-1}}{A_{t-1}}$$

$$= -\left(\frac{E}{A}\right)_t + \frac{E_{t-1}}{A_t} - \frac{E_{t-1}}{A_t} + \frac{E_{t-1}}{A_{t-1}}$$

$$= -\left[\left(\frac{E}{A}\right)_t - \left(\frac{E}{A}\right)_{t-1}\right]$$

Table 3.1: Expected relationship between corporate factors and leverage

Variables	Expected theoretical relation	Mostly reported in the literatures	Theories
Market-to-book	–	–	Market timing theory
	+		Pecking order theory
Tangibility	+	+	Agency theory and trade-off theory
Profitability	–	–	Pecking order theory,
	+		Trade-off theory and other theory: dilution of ownership structure
Firm Size	+	+	Trade-off theory, Agency theory and Other theories: access to the market, economies of scale.
	–		Other theory: information asymmetry
Lagged leverage	–	–	Market timing theory Optimal leverage

divided by total assets and denoted by $\left[-\left(\frac{\Delta RE}{A}\right)_t\right]$. Finally, the residual change in leverage (also known as growth in assets) is defined as lagged book equity divided by total assets minus lagged book equity divided by lagged total assets and denoted as $\left[-\left(\frac{E_{t-1}}{A_t}-\frac{E_{t-1}}{A_{t-1}}\right)\right]$.

3.4.2 External finance weighted average market-to-book and capital structure

External finance weighted average market-to-book (EFWAMB) is used as a proxy for past market timing to capture the effect of past market-to-book ratio on leverage. EFWAMB is defined as:

$$EFWAMB_t = \sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} \times \left(\frac{M}{B}\right)_s \tag{3.5}$$

In (3.5) the parameter, e and d, denote net equity and net debt issues respectively. Net equity issues (e) are defined as the change in book equity minus change in retained earnings. Net debt issues (d) are defined as the residual change in assets. Residual

change in assets is the change in total assets minus change in retained earnings. Market-to-book ratio is assets minus book equity plus market equity all divided by total assets, as mentioned above. Terms "s" and "r" represent the observations available in the sample for the calculation of market-to-book weights. The study sets the minimum weight for market-to-book ratio at zero to avoid the negative weights problem (Baker & Wurgler 2002; Hovakimian 2006). A zero weight is used when there is no information about the market valuation for that year. For example: Data for Autron Corporation Limited (AAT) is used for illustrative purpose to show the calculation of EFWAMB in Table 3.2. A value of zero is substituted when the weight (er + dr) is negative. 3.0338 [(53390531*3.0436+67646692*3.0261)/121037223] is the value of EFWAMB in 2002, for example where, 121037223 is the total of net equity and net debt cumulated over the period from 1997 to 2001 (e.g. 0 to t-1). The equation used in the analysis including EFWAMB in the model is as follows:

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t \quad (3.6)$$

In (3.6), the dependent variable, leverage, is defined in two ways: book value of leverage that is book debt to total assets and market value of leverage that is defined as book debt divided by total assets minus book equity plus market value of equity. Other control variables are defined in section 3.4.1. These definitions follow Fama and French (2000). Lagged leverage is not included in this equation to be consistent with Baker and Wurgler (2002). And, following Baker and Wurgler (2002) firm year observations are dropped when EFWAMB exceeds 10.

Table 3.2: Calculation of EFWAMB using data for AAT

Year	M/B ratio	Net equity (er or es)	Net debt (dr or ds)	er + dr	$\sum_{r=0}^{t-1}(er+dr)$	$\sum_{s=0}^{t-1}(es+ds)$*M/B	$EFWAMB_t$
1997	0.0000	0.0000	0.0000	0.0000			
1998	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1999	1.6815	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2000	3.0436	18163277	35227254	53390531	0.0000	0.0000	0.0000
2001	3.0261	23045908	44600784	67646692	53390531	162499420.2	3.0436
2002	1.4523	1666000	33148000	34814000	121037223	367205074.9	3.0338
2003	1.3297	20225000	25954000	46179000	155851223	417765447.1	2.6805
2004	1.3500	3888000	57294000	61182000	202030223	479169663.3	2.3718
2005	1.0987	-4893000	28258000	23365000	263212223	561765363.3	2.1343

3.4.3 Models used for growth opportunities

In chapter 6 the study analyses whether the past market-to-book (EFWAMB) reflects growth opportunities for Australian firms. To test this, initially the study uses the base model following Baker and Wurgler (2002) and then the model is extended using the variables recommended by Hovakimian (2006). Hovakimian (2006) argues that past market-to-book should have no effect on leverage if net debt issues and net equity issues are controlled for. The study tests the hypothesis that the external finance weighted average market-to-book (EFWAMB*) or past market timing is related to the current leverage $\left(\frac{LT+ST}{A}\right)_t$ because it complements the current market-to-book ratio as a proxy for growth opportunities. The following regression model is used in the analysis.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1} + u_t \quad (3.7)$$

In equation 3.7, leverage is the dependent variable and it is defined as long-term debt plus short-term debt over total assets for the period t. This is also known as current leverage. The control variables consist of the firm characteristics used in previous research (Baker & Wurgler 2002; Fama & French 2002; Frank & Goyal

2003; Rajan & Zingales 1995). The only exception is that the external finance weighted average market-to-book, introduced in chapter 5 as a proxy for past market timing, is denoted with a star here, $(EFWAMB)^*_t$, to highlight the difference in the calculation of these two numbers. The difference comes from the calculation of net debt issues that is used to calculate the weight in the EFWAMB measure. In this case net debt issues are defined as the change in long-term + short-term debt. Lagged leverage is not included in the model to be consistent with Hovakimian (2006).

Equation (3.7) is an extension of the base model (3.6), and includes two additional variables. These are cumulative net equity issued, which is the net equity issued divided by total assets cumulated over all years preceding the current year (net equity issued is measured as the change in book equity minus the change in retained earnings). This is defined as:

$$EqIs = \sum_{i=1}^{t-1} e_i / A \tag{3.8}$$

Cumulative net debt issued is the net debt issued divided by total assets cumulated over all years preceding the current year (net debt issued is measured as the change in long term plus short term debt). This is defined as:

$$DbIs = \sum_{i=1}^{t-1} d_i / A \tag{3.9}$$

3.4.4 Future market-to-book/market timing and leverage

The basic leverage regression (3.3) as well as the leverage regression (3.6) are reorganised using future external finance weighted average market-to-book (FEFWAMB) as a proxy for future market timing and external finance. FEFWAMB is defined as:

$$FEFWAMB_t = \sum_{s=t+1}^{t+n} \frac{e_s + d_s}{\sum_{r=t+1}^{t+n} e_r + d_r} \times \left(\frac{M}{B}\right)_s \tag{3.10}$$

FEFWAMB is the weighted average of a time series of future market-to-book ratios that start with the observation available in the sample (t + 1) and end with the market-to-book ratio at (t + n). Here, following Hovakimian (2006) net equity issues (e) is defined as change in book equity minus change in retained earnings and net debt issues (d) is defined as change in long-term plus short-term debt. Again, data for Autron Corporation Limited (AAT) is used for illustrative purpose to show the calculation of FEFWAMB (Table 3.3).

In Table 3.3 for example, FEFWAMB value for AAT in 2002 is 1.2555 [(32208000*1.3297+33776000*1.3500+35583000*1.0987)/101567000]. 101567000 is the total of net equity and net debt cumulated over the period from 2003 to 2005 (e.g. t+1 to t+n). And the regression equation used in the analysis including FEFWAMB is as follows:

$$\left(\frac{LT+ST}{A}\right)_t = a + b\left(FEFWAMB\ \right)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog\,(S)_{t-1} + u_t \qquad (3.11)$$

Table 3.3: Calculation of FEFWAMB using data for AAT

Year	M/B ratio	Net equity (er or es)	Net debt (dr or ds)	er + dr	$\sum_{r=t+1}^{t+n}(er+dr)$	$\sum_{s=t+1}^{t+n}(es+ds)*M/B$	$FEFWAMB_t$
1997	0.0000	0.0000		0.0000	172099134	294314606.7	1.7101
1998	0.0000	0.0000	-329314	0.0000	172099134	294314606.7	1.7101
1999	1.6815	0.0000	2435603	2435603	169663531	290219140.3	1.7106
2000	3.0436	18163277	5412529	23575806	146087725	218463817.2	1.4954
2001	3.0261	23045908	-6343183	16702725	129385000	167919701.1	1.2978
2002	1.4523	1666000	26152000	27818000	101567000	127519679.7	1.2555
2003	1.3297	20225000	11983000	32208000	69359000	84692642.1	1.2211
2004	1.3500	3888000	29888000	33776000	35583000	39095042.1	1.0987
2005	1.0987	-4893000	40476000	35583000			

The study re-estimates the change in leverage regression by substituting FEFWAMB for EFWAMB to see whether the effect of future market timing has an impact on change in leverage using the following model.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

(3.12)

In this model, the dependent variable, change in leverage, is defined as leverage at time (t) minus leverage at time (t-1) where leverage is the combination of long term plus short term debt.

3.4.5 Models used for industry effect

In chapter 7, the study re-estimates the model of Baker and Wurgler (2002) and Hovakimian (2006) applying dummy variables (Dummy) in the original regression to test for statistically significant differences in mining verses non-mining firm coefficient estimates. The dummy is set to 1 for non-mining firms (Dummy = 1) and set to 0 for mining firms (Dummy = 0). For example, following Baker and Wurgler (2002), the study analyses the change in leverage regression to examine whether the market-to-book effect comes from net equity issues as market timing implies. A statistical test on the dummy variable coefficients provides a test for significant difference in estimated coefficients between mining and non-mining firms. The equation takes the following form:

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + g\left(\frac{M}{B}\right)_{t-1} * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + j\log(S)_{t-1} * Dummy + k\left(\frac{D}{A}\right)_{t-1} * Dummy + u_t$$

(3.13)

The first line of the regression model provides estimates of the coefficients that apply to the mining firms and the second line of coefficients refers to the difference in the coefficients (the coefficient for the non-mining firms less the coefficient for the mining firms).

The Wald-test is one of a number of ways of testing the parameters associated with a group of explanatory variables (Agresti 1990; Polit 1996). Wald-tests in chapter 7 are relied upon to examine whether there is any significant difference between mining and non-mining firm coefficients as a group.

3.4.6 Models used for liquidity effect

In the final analysis chapter of the thesis, three different measures are used as proxies for transaction costs or liquidity effect. These are bid-ask spread, volume of trade and the zero return measure. These measures are included in Baker and Wurgler's (2002) EFWAMB model and Hovakimian's (2006) model to capture the liquidity effect on Australian firm capital structure.

The difference between a stock's bid and ask price is known as the bid-ask spread. Bid-ask spreads are commonly used as a proxy for transaction costs (Chang et al. 2002; Clinton 1988; Fletcher & Taylor 1996; Rhee & Chang 1992). The study takes the natural logarithm of the yearly average of bid-ask spread to capture transaction costs/liquidity effects. For example: the equation using bid-ask spread (BAS) in the original EFWAMB model (3.6), takes the following form:

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB\ )_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1}$$
$$+ g(EFWAMB\ )_t * BAS + h\left(\frac{M}{B}\right)_{t-1} * BAS + i\left(\frac{PPE}{A}\right)_{t-1} * BAS + j\left(\frac{EBITDA}{A}\right)_{t-1} * BAS$$
$$+ k\log(S)_{t-1} * BAS + u_t \qquad (3.14)$$

The first line of the regression model provides estimates of the coefficients that apply to the main effects and the second line of coefficients refers to the interaction effects (coefficient shows whether the leverage is sensitive to liquidity with respect to the variable of interest).

Volume of trade or trading volume is measured by the number of shares traded for a stock on a particular day. This figure is expressed in thousands. Intuitively, higher transaction costs would be associated with lower trade volume. This measure has been used in previous studies (Barclay, Kandel & Marx 1998; Lo, Mamaysky & Wang 2001; Pagano 1989). Similar to bid-ask spread measure, the study takes the log of average daily trading volume for the year. For example: the equation using volume of trade (VO) in the original EFWAMB model (3.6), takes the following form:

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + g(EFWAMB)_t * VO + h\left(\frac{M}{B}\right)_{t-1} * VO + i\left(\frac{PPE}{A}\right)_{t-1} * VO + j\left(\frac{EBITDA}{A}\right)_{t-1} * VO + k\log(S)_{t-1} * VO + u_t \quad (3.15)$$

A further estimate has been proposed as a proxy for transaction costs (Lesmond, Ogden & Trzcinka 1999). This measure is known as the zero-return measure. This is also used as a proxy for transaction costs in recent research to explain the impact of liquidity (Goyenko, Holden & Trzcinka 2008). According to Lesmond, Ogden and Trzcinka (1999) stocks with lower liquidity have more zero trading volume days and thus are more likely to have zero-return days. The proportion of zero-return is calculated as follows:

$$Zero = \frac{\text{Number of days with zero returns in the year}}{\text{Total trading days in the year}} \quad (3.16)$$

For example: the equation using zero-return measure (zero) in the original EFWAMB model (3.6), takes the following form:

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + g(EFWAMB)_t * zero + h\left(\frac{M}{B}\right)_{t-1} * zero + i\left(\frac{PPE}{A}\right)_{t-1} * zero + j\left(\frac{EBITDA}{A}\right)_{t-1} * zero + k\log(S)_{t-1} * zero + u_t \quad (3.17)$$

In (3.17) the second line of coefficients refers to the interaction effect using zero-return measure (zeros) to capture the liquidity effect on the explanatory variables in the equation.

3.5 CONCLUSION

The objective of the study is to examine the capital structure choice of Australian firms by capturing the relationship between leverage and market-to-book as well as the relationship between leverage and transaction costs. The thesis uses two different methods – pooled OLS and fixed effect panel data analysis. Wald-tests are employed in chapter 7 to test for differences between the mining and non-mining firm leverage decision. Finally, three different measures are used to test for the impact of transaction costs/liquidity effect in chapter 8 (bid-ask spread, volume of trade and zero-return).

CHAPTER 4

DATA

4.1 INTRODUCTION

This chapter describes the data sets used for the thesis. The data used for the first three analysis chapters consists of all listed and delisted companies from Fin Analysis and Dat Analysis for the period of 1997-2005 provided by Aspect Huntley. Historical data are collected that allow the author to analyse the persistence of market timing over the study period. Baker and Wurgler (2002) choose to analyse the capital structure choice of US firms for the period from 1968 to 1999 and Hovakimian (2006) examine US capital structure choice by considering the period between 1983 and 2002. This study considers the Australian firms over the period from 1997 to 2005. Though Aspect Huntley's historical data are available from the 1989, the data prior to 1995 are often missing and market coverage is much reduced. Financial companies are also excluded from the study due to a lack of critical data, and to be consistent with previous research (Baker & Wurgler 2002; Hovakimian 2006; Leary & Roberts 2005). In addition, bid-ask spread, volume of trade and return index are collected from DataStream to capture the transaction costs/liquidity effect for the final analysis chapter. Three data sets are used in analysis; an unfiltered data set, a Baker and Wurgler (2002) filtered data set and a four standard deviation filtered data set.

4.1.1 Unfiltered data

The first is the full data set that represents all available data over the period from 1997-2005 and this is referred as the unfiltered data. The initial sample consists of 1585 non-financial companies with variables; Retained profit, Total asset, Total liabilities, Total revenue, EBITDA (earning before interests, taxes, depreciation and amortization), Market capitalization and Net PP&E (net plant, property and equipment). These are used to compute book leverage, market leverage, net debt issues, net equity issues and newly retained earnings. Due to inadequate information

147 companies are dropped and the final sample used for the unfiltered data set includes 1438 companies.

4.1.2 Baker and Wurgler (2002) filtered data

The second is a filtered data set and it is based on the Baker and Wurgler (2002) filtered data. Following Baker and Wurgler (2002), firm year observations are dropped where book leverage is above 1, book value of assets is below $10 million[3], market-to-book ratio is above 10 or when external finance weighted average market-to-book (EFWAMB) is above 10. Hence, Baker and Wurgler (2002) filtered data is much more restricted that basically considers large firms. This reduces the sample from 1438 to 981 with 3,595 firm year observations available for cross section analysis

4.1.3 Four Standard Deviation filtered data

The second filtered data set uses the four standard deviation filtered data. This is designed to reduce the effect of outliers in the unfiltered data, especially during the period around 1999 to 2004. The final sample is reduced from 1438 to 1146 firms with 4,681 firm year observations available for analysis. In this filter firm year observations are excluded for each variable when they exceed the range of mean ± four standard deviations. It should be noted that even though this filter excludes 20% of all firms it does not exclude any of the top 50 companies listed in ASX (For example, the data set includes BHP, RIO TINTO, TELSTRA and NEW CREST MINING), represent approximately 60% of the Australian market value.

The Table 4.1 below shows the number of companies and number of years in the data set. Total 4,939 firm year observations available for 1438 companies for the unfiltered data set.

[3] Baker and Wurgler (2002) drop firm year observations when minimum book value of assets is below US $10 million. This study considers Australian $10 million as the minimum value.

Table 4.1: Distribution of companies based on data availability

Number of Years of Data Available	Number of Companies
10	2
9	103
8	335
7	156
6	147
5	166
4	114
3	99
2	143
1	173
Total	**1438**

Table 4.2 summarises the data sets used to compile the sample. Table 4.3 summarizes the final sample size for each data set included in statistical tests for the period, 1997-2005. In Table 4.3, unfiltered refers to the data set that includes all available data, 4SD refers to the Four Standard Deviation (SD) filtered data and BW refers to the Baker and Wurgler (2002) filtered data. When 4SD filtered data is used, sample firms reduce from 1438 to 1146 (292 firms dropped) and when BW filtered data is used, sample firms reduce from 1438 to 981 (457 firms dropped).

Table 4.2: Sample Size (1997-2005)

	Firms	Firm-Year Observations
Initial sample of firms	1585	1,4265
No accounting data	147	1323
Data with total observations	1438	1,2942
Data with incomplete observations	1438	8003
Final data with complete observations	1438	4939

Table 4.3: Firm year observations for each filtered data set (1997-2005)

Panel 1: Firm year observations included in equations 3.3 and 3.4

	Unfiltered	**4SD filter**	**BW filter**
Available firms	1438	1146	981
Total panel observations	4939	4681	3612

Panel 2: Firm year observations included in other equations

	Unfiltered	**4SD filter**	**BW filter**
Available firms	1438	1146	981
Total panel observations	4939	4681	3595[4]

4.2 ANALYTICAL APPROACH

Baker and Wurgler (2002) analyse the capital structure choice of a firm using the IPO date as the first date for data collection because IPO listing is an important financing decision point for many corporations. Literature based on IPO underpricing has been widely documented in Australia as well (Brailsford, Heaney & Shi 2001; Da Silvia Rosa 1995; How 2000; Lee, Taylor & Walter 1996; Murgulov & Naughton 2002). While this approach helps understanding of the gradual development of leverage from initial listing of the firm, this approach is not appropriate for Australian analysis.

[4] Firm year observations are dropped when EFWAMB exceed the value over 10.

Table 4.4: Number of Australian IPOs

Year	IPO Issues	Year	IPO Issues
1997	86	2002	115
1998	53	2003	157
1999	166	2004	247
2000	238	2005	195
2001	119		

Australian data is limited in terms of the number and size of IPO issues**.** For example for the period 1997-2005 the highest no. of IPO issued in a year was 247 (recorded in 2004)[5]. Doukas, Guo & Zhou (2009) in their recent article[6] state, "While IPOs are likely to be seriously influenced by market timing considerations, they represent capital structure decisions that occur only once in a firm's life cycle. Further, IPOs are largely associated with relatively small, young firms characterized by high growth opportunities—not necessarily the most representative sample of firms to draw broad inferences about the effects of external financing on firm capital structure".

IPO activity increased in late 1999 and 2000. This jump in the number of IPOs was primarily due to IT and IT-related IPOs listed on the ASX which accompanied increased IT share prices, more than double in the first half of 1999. However, prices fell sharply thereafter with very few IT companies listed after 2001. Again in the second half of 2003 IPO activity increased with the increase in global equity markets and more optimistic global economic outlook. This increase in IPO listings is driven by the listings of materials companies, especially mining companies.[7] Indeed, in the Baker and Wurgler (2002) study many IPO's failed to survive to the end of the 10 year study period. This effect is much more severe for Australian IPO's.

[5] IPO issues are collected from the Connect 4 Data base using the company prospectus information.
[6] See Doukas, J, Guo, J & Zhou, B 2009, "Hot Debt Markets and Capital Structure" *presented at EFMA annual meetings 2009,* (http://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2009-milan/confpap09.shtml)
[7] Information's are collected from the Reserve Bank of Australia's website: http://www.rba.gov.au/PublicationsAndResearch/StatementsOnMonetaryPolicy/Boxes/2004/index.html

One way of getting around this problem, is to consider a more general approach, that of examining the financing activities of all available Australian firms using listed and delisted firms over a reasonably long period of time. Rather than starting with the IPO decision which results in a small sample of Australian start up firms, the study is based on all available firms over the study period from 1997-2005 (Kayhan & Titman 2007; Titman & Wessels 1988).

4.3 TIMING, GROWTH OPPOURTUNITIES AND INDUSTRY EFFECT

The data set used for market timing (Baker & Wurgler 2002), growth opportunities (Hovakimian 2006) and broad industry effects are discussed in this section.

4.3.1 Data set used for market timing analysis

While analysing the market timing hypothesis in chapter 5 the data is divided into two categories, full period and sub-period data for each of the three filters. The full period is from January 1997 to December 2005 as discussed in earlier sections and sub-periods include 1997-1999, 2000-2001 and 2002-2005. Three-year sub-periods are included in the study to allow for the possibility of structural change. The first sub-period includes the Asian financial market crisis and the post-Asian financial market crisis (1997-99). The second sub-period covers the internet crisis (2000-02) and the final sub-period of 2003-2005 is a period of high growth. The three-year sub-period data are only used in estimation of equations 3.3 and 3.4 in analysis to provide some indication of the stability of the result over time.

4.3.2 Data set used for growth opportunities analysis

This study uses all available firms as well as two different filtered data sets for analysis. Following Hovakimian (2006), similar to Baker and Wurgler (2002) approach, firm year observations are dropped where leverage is above 1, minimum book value of assets below $10 million, when the market-to-book ratio is above 10 or when external finance weighted average market-to-book (EFWAMB) is above 10.

Further, financial firms are excluded from the study to be consistent with previous research. Thus, the data set is similar to the previous studies (4,939 firm year observations are used for unfiltered data, 3,595 firm year observations are used for Baker and Wurgler (2002) filtered data and 4,681 firm year observation are used in the cross section analyses for four standard deviation filtered data)[8].

4.3.3 Data set used for industry effect segments

Data is also divided into two sub samples; mining and non-mining firms. A firm is considered to be from the mining sector if it has general industry classification code (GICS) of 15 and from the non-mining sector if it has GICS code of 10, 20, 25, 30, 35, 40, 45 and 55[9]. Financial firms are excluded from the sample. Table 4.5 summarizes the final sample size for each data set included in statistical tests for chapter 7 using the period between 1997 and 2005.

Table 4.5: Number of firms and firm year observations in mining and non-mining firms for each filtered data set (1997-2005)

Available firms	Unfiltered data	4 SD filtered data	BW filtered data
Mining	470	358	284
Non-mining	968	788	697
Total	**1438**	**1146**	**981**
Firm year observation			
Mining	1479	1400	857
Non-mining	3460	3281	2738
Total	**4939**	**4681**	**3595**

4.4 LIQUIDITY EFFECT

Market liquidity will have an impact on the ease with which a company can issue its shares. Liquidity is the subject of the final chapter of the thesis (chapter 8). Three measures of liquidity include bid-ask spread, volume of trade and zero returns. Bid

[8] Long-term debt and short-term debt are used to compute book leverage and net debt issued following Hovakimian (2006) for each company over the 9 year period of the study.
[9] GICS code collected from Fin and Dat Analysis data base (Standard & Poor's and MSCI Barra – GICS Structure).

price, ask price, volume of trade and return index are collected from DataStream. However, DataStream does not provide adequate coverage of these values especially for bid and ask price before 2001. Thus the study focuses on liquidity effect over the period from 2001 to 2005. The sample size remains at 1438 companies for unfiltered data, 1146 companies for four standard deviation filtered data and 981 companies for Baker and Wurgler (2002) filtered data though firm year observations are reduced. Table 4.6 summarizes the final sample size for each data set included in statistical tests based on the period from 2001 to 2005.

Table 4.6: Number of firms and firm year observations available based on liquidity measures for each filtered data set (2001-2005)

Filters	**Liquidity Measures**		
Unfiltered data	**Bid-Ask Spread**	**Volume of Trade**	**Zero Return**
Available firms	1438	1438	1438
Total Panel Observations	**3450**	**3450**	**3450**
4 SD filtered data			
Available firms	1146	1146	1146
Total Panel Observations	**3434**	**3434**	**3434**
BW filtered data			
Available firms	981	981	981
Total Panel Observations	**2532**	**2532**	**2532**

4.5 CONCLUSION

This study used three different data sets; unfiltered, Baker and Wurgler (2002) filtered and four standard deviation filtered data for each analysis chapter during the period from 1997-2005. The only exception is the final analysis chapter where due to inadequate coverage of liquidity estimates the study focuses on the period from 2001-2005. Historical data are collected from Huntley database. Further, to capture the liquidity affects data for bid-ask spread, volume of trade and zero-return are collected from DataStream.

CHAPTER 5

MARKET TIMING AND CAPITAL STRUCTURE

5.1 INTRODUCTION

Recent studies of Baker and Wurgler (2002) suggest that choice of financing is hard to explain within the traditional theories. Yet, it is argued that equity market timing is an important aspect of corporate financial decision-making. Literature based on the theory of market timing using Australian evidence is limited. The objective of this first analysis chapter is to focus on this dynamic theory of market timing (Baker and Wurgler 2002) and its impact on capital structure choice using Australian firms. The basic question that is asked here is whether market timing has an impact, either in the short run or long run, on Australian firm capital structure.

Baker and Wurgler (2002) show that market timing has a very large and persistent effect on the capital structure of US firms. They argue that firms do not participate in capital structure rebalancing subsequent to issuing equity. Further, they show that historical market-to-book ratios have a statistically significant impact on current capital structure (Bie & Haan 2007; Faulkender 2005; Hovakimian 2006). The authors argue that the persistent impact of past market-to-book on leverage is not due to the trade-off or pecking order theories but to equity market timing. As a result, capital structure is the cumulative outcome of past attempts at equity market timing (Elliott, Koeter-Kant & Warr 2007). Baker and Wurgler's (2002) empirical results are also supported by the survey of US corporate executives conducted by Graham and Harvey (2001).

Analysis shows that market timing appears to have an impact on capital structure through net equity issues as the market timing theory implies. This study also documents that high market valuation appears to lead to a reduction in leverage. And, based on Baker and Wurgler (2002) filtered data and unfiltered data this study finds evidence that past market-to-book has a significant negative impact especially on book leverage, consistent with Baker and Wurgler's findings. However, the study finds some variation in the results when using a four standard deviation filtered data.

The four standard deviation filtered results show an insignificant positive relationship between past and current market-to-book with book leverage[10]. In addition, in contrast with the Baker and Wurgler (2002) findings, the results show that the current market-to-book is more important in explaining the cross section in leverage. This suggests that the effect of equity market timing is not long lasting. This finding supports the trade-off theory.

5.2 DATA AND SUMMARY STATISTICS

The data used in this analysis are discussed in chapter 4. It should be noted that full period and three year sub-period data sets are used in this analysis. Three year sub-period data are used in 3.3 and 3.4 cross-sectional analysis. Sample sizes for the three full period data sets are reported in Table 5.1.

Table 5.1: Firm year observations for each filtered data set (1997-2005)

	Unfiltered data	4SD filtered data	BW filtered data
Available firms	1438	1146	981
Total panel observations	4,939	4,681	3,612[11]

The initial analysis of the impact of the firm's history of market-to-book ratios on its capital structure is accounted based on the descriptive statistics. The prime question that is asked here is whether market-to-book affects leverage through net equity issues as the market timing theory implies. Panel A, B and C of Table 5.2 contains descriptive statistics for the unfiltered data, the Baker and Wurgler (2002) filtered data set and a four standard deviation filtered data set respectively.

[10] Chapter 3 – Research Methodology or Appendix A5.1 for variable definitions
[11] However, firm year observations are dropped to 3595 when EFWAMB exceed the value over 10.

Table 5.2: Panel A: Year wise descriptive statistics (Unfiltered data)

Mean, Standard Deviation, Minimum and Maximum values are documented for Book value of leverage ($\frac{D}{A}$, book debt to assets), Market value leverage ($\frac{D}{A}$, book debt divided by total assets minus book equity plus market equity), Net equity issues (e/A, change in book equity minus the change in retained profits divided by assets), Net debt issues (d/A, residual changes in assets divided by assets), Market-to-book ratio (M/B Ratio, assets minus book equity plus market equity all divided by assets), External finance weighted average market-to-book ratio (EFWAMB), Firm size ($\log(S)$, log of total revenue), Fixed asset tangibility $\left(\frac{PPE}{A}\right.$, net property, plant and equipment divided by assets), Profitability $\left(\frac{EBITDA}{A}\right.$, operating income before interest, taxes and depreciation divided by assets) and newly retained profit $\left(\Delta RE/A\right.$, change in retained earnings divided by assets). SD is the standard deviation. The sample consists of non-financial industry data for the period from 1997 to 2005*

Year	Total	1998	1999	2000	2001	2002	2003	2004	2005
Firm year observations	4939	134	366	522	626	736	829	849	877
Book Leverage, $\frac{D}{A}$									
Mean	0.81	0.50	0.47	0.41	0.42	0.46	1.95	1.11	0.42
Median	0.41	0.51	0.54	0.41	0.42	0.40	0.38	0.35	0.40
SD	14.24	0.18	0.23	0.32	0.35	0.63	28.44	19.70	0.56
Minimum	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	667.63	0.99	1.60	3.46	3.72	12.50	667.6	573.8	8.44
Market Leverage, $\frac{D}{A}$									
Mean	0.31	0.40	0.41	0.33	0.35	0.33	0.32	0.26	0.26
Median	0.27	0.39	0.41	0.29	0.32	0.28	0.27	0.19	0.27
SD	0.24	0.20	0.23	0.26	0.26	0.26	0.24	0.22	0.22
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.98	0.97	0.96	0.95	0.96	0.98	0.97	0.96	0.97
Net Debt Issues, d/A									
Mean	0.02	0.09	0.05	0.16	0.13	-0.31	0.10	-0.11	0.16
Median	0.08	0.08	0.06	0.11	0.08	0.03	0.04	0.13	0.05
SD	5.59	0.41	0.32	0.74	0.77	4.32	8.56	9.57	1.30
Minimum	-244.7	-2.40	-2.06	-7.68	-8.72	-98.87	-125.1	-244.7	-20.1
Maximum	189.6	0.99	1.34	7.93	7.40	4.17	189.6	113.5	8.43
Net Equity Issues, e/A									
Mean	0.12	0.01	0.03	0.19	0.14	0.00	0.12	0.17	0.18
Median	0.03	0.01	0.01	0.03	0.03	0.01	0.01	0.08	0.03

SD	1.10	0.31	0.22	0.55	0.80	1.59	1.42	1.13	0.96
Minimum	-31.00	-2.34	-1.95	-4.53	-8.72	-31.00	-20.11	-21.48	-11.37
Maximum	20.33	0.84	1.24	7.93	9.01	9.62	20.33	9.34	8.42
M/B Ratio									
Mean	2.51	2.09	0.59	1.75	1.89	1.99	2.02	4.11	3.64
Median	1.31	1.58	1.23	1.17	1.26	1.27	1.30	1.32	1.21
SD	19.84	2.75	1.54	2.09	2.07	3.54	3.69	37.84	28.19
Minimum	0.00	0.77	0.00	0.09	0.16	0.09	0.18	0.18	0.27
Maximum	881.5	29.32	24.49	21.95	20.56	59.68	72.58	881.5	727.5
EFWAMB									
Mean	2.24	0.00	0.00	1.75	1.89	1.96	2.03	2.03	2.59
Median	0.55	0.00	0.00	0.00	0.07	0.85	0.84	1.56	0.41
SD	7.34	0.00	0.01	2.45	2.17	2.14	3.30	2.76	11.30
Minimum	0.00	0.00	0.00	0.60	0.09	0.16	0.09	0.09	0.09
Maximum	310.58	0.00	0.16	24.49	21.95	20.56	59.68	48.30	310.58
Firm size, $\log(S)$									
Mean	7.12	8.18	7.72	7.08	7.15	7.02	7.02	7.02	7.01
Median	7.39	8.44	8.51	7.43	7.41	7.24	7.21	7.19	7.26
SD	1.50	1.15	1.16	1.58	1.45	1.57	1.51	1.49	1.50
Minimum	1.32	4.40	3.85	2.51	3.07	1.70	1.70	1.32	2.20
Maximum	10.66	10.31	10.39	10.36	10.55	10.65	10.55	10.66	10.53
Fixed asset tangibility, $\left(PPE/A\right)$									
Mean	0.34	0.30	0.39	0.47	0.29	0.48	0.32	0.28	0.22
Median	0.16	0.27	0.34	0.24	0.22	0.13	0.12	0.12	0.13
SD	2.23	0.25	0.93	2.82	0.33	4.47	2.23	1.08	0.29
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	107.7	1.13	16.02	51.88	3.54	107.74	63.50	30.24	3.41
Profitability, $\left(EBITDA/A\right)$									
Mean	-0.36	0.11	0.09	-0.02	0.21	-0.14	-0.08	-1.23	-0.81
Median	0.05	0.13	0.12	0.07	0.06	0.02	0.00	0.00	0.00
SD	14.34	0.14	0.15	0.36	5.61	0.58	1.44	27.55	19.96
Minimum	-795.7	-0.62	-1.23	-4.89	-3.64	-6.98	-9.51	-795.7	-590.1
Maximum	140.0	0.39	0.60	0.64	140.0	3.38	34.00	7.16	2.01
Newly retained profit, $\Delta RE/A$									
Mean	-0.67	0.01	-0.06	-0.13	-0.29	-0.36	-2.84	-0.28	-0.19
Median	-0.02	0.01	0.01	-0.02	-0.03	-0.03	-0.04	-0.02	-.0.05
SD	17.95	0.28	0.31	0.60	1.17	3.67	43.30	4.54	1.46
Minimum	-822.4	-1.29	-2.36	-7.24	-16.21	-71.50	-822.4	-113.50	-17.59
Maximum	45.87	1.81	1.69	4.63	7.60	32.22	24.98	45.87	21.10

* Due to use of lagged value, no data are included for 1997.

Panel B: Year wise descriptive statistics (Baker and Wurgler (2002) filtered data)

Firm year observations with book leverage above 1, book value of assets below $10 million, M/B ratio greater than 10 and EFWAMB greater than 10 are excluded from the sample. Variable definitions are in Panel A.

Year	Total	1998	1999	2000	2001	2002	2003	2004	2005
Firm year observations	3612	123	350	416	516	543	529	537	598
Book Leverage, $\frac{D}{A}$									
Mean	0.43	0.52	0.47	0.45	0.45	0.44	0.42	0.40	0.40
Median	0.41	0.51	0.54	0.41	0.42	0.41	0.40	0.37	0.37
SD	0.22	0.16	0.21	0.22	0.23	0.22	0.22	0.22	0.22
Minimum	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	1.00	0.99	0.98	0.95	0.98	0.99	1.00	0.99	0.95
Market Leverage, $\frac{D}{A}$									
Mean	0.36	0.41	0.42	0.41	0.41	0.38	0.36	0.30	0.30
Median	0.27	0.39	0.41	0.29	0.32	0.29	0.28	0.21	0.20
SD	0.23	0.18	0.22	0.24	0.25	0.24	0.22	0.21	0.21
Minimum	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.97	0.97	0.96	0.95	0.96	0.96	0.96	0.93	0.89
Net Debt Issues, d/A									
Mean	0.07	0.12	0.05	0.12	0.09	0.02	0.00	0.05	0.13
Median	0.08	0.08	0.06	0.11	0.08	0.04	0.03	0.11	0.13
SD	0.60	0.28	0.28	0.29	0.37	0.37	0.59	1.20	0.43
Minimum	-27.20	-1.90	-1.96	-2.18	-2.49	-4.48	-10.49	-27.20	-7.27
Maximum	3.66	0.79	0.80	0.95	3.66	1.08	1.36	0.86	1.34
Net Equity Issues, e/A									
Mean	0.05	0.02	0.01	0.09	0.08	0.04	0.01	0.03	0.07
Median	0.03	0.01	0.01	0.03	0.03	0.02	0.01	0.06	0.05
SD	0.56	0.22	0.21	0.22	0.30	0.21	0.53	1.19	0.40
Minimum	-27.21	-2.07	-1.95	-2.03	-2.08	-1.76	-10.42	-27.21	-7.38
Maximum	3.88	0.38	0.75	1.12	3.88	1.13	0.86	0.97	1.07
M/B Ratio									
Mean	1.55	1.72	1.22	1.42	1.64	1.49	1.50	1.55	1.79
Median	1.31	1.58	1.23	1.17	1.26	1.20	1.26	1.28	1.58
SD	1.10	0.73	0.63	1.04	1.31	1.17	1.01	1.09	1.18
Minimum	0.09	0.84	0.19	0.13	0.16	0.09	0.23	0.17	0.29
Maximum	9.59	5.00	5.07	8.99	9.47	9.59	8.19	9.29	9.42

EFWAMB									
Mean	1.66	0.00	0.00	1.53	1.55	1.67	1.62	1.64	1.66
Median	0.55	0.00	0.00	0.00	0.07	0.41	0.85	1.59	2.67
SD	1.24	0.00	0.00	0.97	1.09	1.35	1.30	1.24	1.21
Minimum	0.09	0.00	0.00	0.60	0.14	0.16	0.09	0.09	0.09
Maximum	9.35	0.00	0.01	7.79	9.35	8.98	9.15	8.37	8.90
Firm size, $\log(S)$									
Mean	7.73	8.35	7.78	7.71	7.68	7.72	7.72	7.76	7.65
Median	7.40	8.45	8.51	7.44	7.41	7.32	7.27	7.28	7.26
SD	1.22	0.95	1.14	1.22	1.17	1.21	1.27	1.24	1.30
Minimum	1.32	4.70	3.85	3.28	3.14	3.61	2.97	1.32	3.00
Maximum	10.66	10.31	10.39	10.36	10.62	10.65	10.55	10.66	10.53
Fixed asset tangibility, $\left(PPE/A\right)$									
Mean	0.32	0.32	0.38	0.36	0.32	0.28	0.31	0.34	0.27
Median	0.16	0.27	0.34	0.24	0.22	0.15	0.14	0.13	0.11
SD	0.63	0.25	0.88	0.29	0.28	0.25	0.29	1.32	0.27
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	30.24	1.13	16.02	2.00	2.36	1.35	2.73	30.24	1.96
Profitability, $\left(EBITDA/A\right)$									
Mean	0.08	0.13	0.10	0.09	0.09	0.05	0.07	0.08	0.08
Median	0.05	0.13	0.12	0.07	0.06	0.01	0.02	0.03	0.03
SD	0.17	0.09	0.12	0.14	0.15	0.21	0.17	0.20	0.18
Minimum	-2.16	-0.14	-0.50	-0.67	-0.69	-2.16	-0.79	-1.91	-1.07
Maximum	1.14	0.39	0.60	0.62	0.98	0.68	1.14	0.92	0.78
Newly retained profit, $\Delta RE/A$									
Mean	-0.05	0.07	-0.01	-0.07	-0.18	-0.09	0.01	-0.01	-0.03
Median	-0.02	0.01	0.01	-0.02	-0.03	-0.04	-0.02	0.00	-0.03
SD	0.56	0.38	0.24	0.44	1.03	0.31	0.63	0.40	0.45
Minimum	-16.62	-0.31	-0.69	-5.08	-16.62	-2.63	-1.26	-1.23	-1.48
Maximum	10.03	1.81	1.69	2.31	0.61	1.20	10.03	6.59	6.86

Panel C: Year wise descriptive statistics (Four Standard Deviation filtered data)

Variable definitions are in Panel A.

Year	Total	1998	1999	2000	2001	2002	2003	2004	2005
Firm year observations	4681	134	130	519	624	733	823	844	874
Book Leverage, $\frac{D}{A}$									
Mean	0.44	0.50	0.52	0.41	0.42	0.46	0.46	0.41	0.41
Median	0.41	0.51	0.54	0.41	0.42	0.41	0.40	0.37	0.37
SD	0.49	0.18	0.17	0.32	0.35	0.63	0.59	0.51	0.49
Minimum	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	12.50	0.99	0.98	3.46	3.72	12.50	7.97	7.63	7.46
Market Leverage, $\frac{D}{A}$									
Mean	0.31	0.40	0.41	0.33	0.34	0.33	0.31	0.26	0.26
Median	0.27	0.39	0.41	0.29	0.32	0.28	0.28	0.20	0.20
SD	0.24	0.20	0.20	0.26	0.26	0.26	0.24	0.22	0.22
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	0.98	0.97	0.90	0.95	0.96	0.98	0.97	0.96	0.97
Net Debt Issues, d/A									
Mean	0.02	0.09	0.08	0.16	0.12	-0.31	-0.09	0.04	0.17
Median	0.08	0.08	0.06	0.11	0.08	0.05	0.03	0.12	0.14
SD	2.27	0.41	0.26	0.74	0.77	4.33	2.14	2.40	1.09
Minimum	-98.87	-2.40	-1.31	-7.68	-8.72	-98.87	-34.73	-48.23	-12.09
Maximum	8.43	0.99	1.34	7.93	7.40	4.17	7.52	4.45	8.43
Net Equity Issues, e/A									
Mean	0.12	0.01	0.04	0.19	0.14	0.00	0.08	0.16	0.16
Median	0.03	0.01	0.01	0.03	0.03	0.03	0.01	0.06	0.06
SD	1.07	0.31	0.19	0.55	0.80	1.59	1.18	1.09	0.93
Minimum	-31.00	-2.34	-0.85	-4.53	-8.72	-31.00	-20.11	-21.48	-11.37
Maximum	9.62	0.84	1.24	7.93	9.01	9.62	9.05	7.02	8.42
M/B Ratio									
Mean	2.03	2.09	1.66	1.74	1.89	1.99	2.03	2.07	2.33
Median	1.31	1.58	1.23	1.17	1.26	1.21	1.27	1.29	1.59
SD	2.87	2.75	2.21	2.09	2.07	3.55	3.70	2.52	2.60
Minimum	0.00	0.77	0.00	0.09	0.16	0.09	0.18	0.18	0.27
Maximum	72.58	29.32	24.49	21.95	20.56	59.68	72.58	35.30	32.76
EFWAMB									
Mean	1.93	0.00	0.00	1.52	1.84	1.90	1.87	1.89	1.95
Median	0.55	0.00	0.00	0.00	0.07	0.41	0.85	1.57	2.70
SD	1.86	0.00	0.00	0.95	1.94	1.87	1.84	1.80	1.92
Minimum	0.09	0.00	0.00	0.60	0.09	0.16	0.09	0.09	0.09

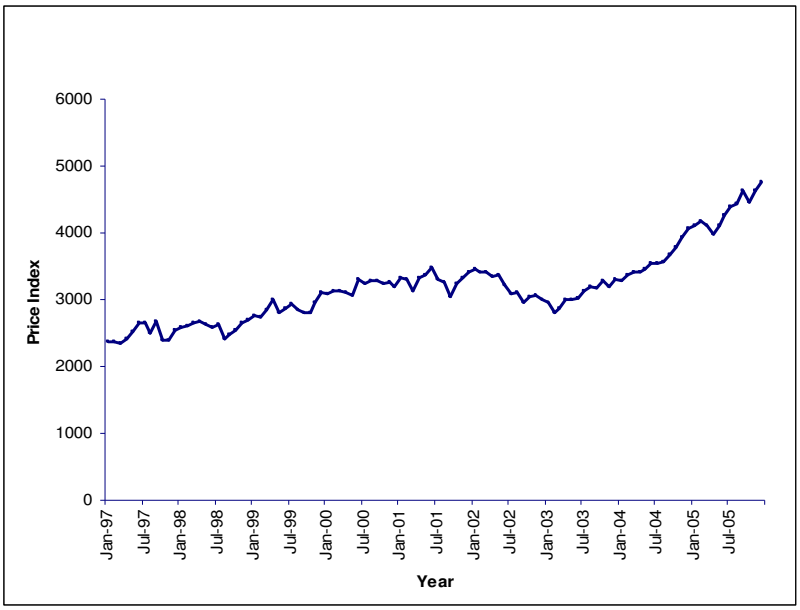
Maximum	17.66	0.00	0.06	7.79	17.30	17.30	17.52	17.66	17.55
Firm size, $\log(S)$									
Mean	7.11	8.18	8.30	7.08	7.15	7.02	7.02	7.02	7.01
Median	7.39	8.45	8.51	7.43	7.41	7.31	7.26	7.27	7.24
SD	1.52	1.15	1.13	1.58	1.45	1.57	1.51	1.49	1.50
Minimum	1.32	4.40	4.33	2.51	3.07	1.70	1.70	1.32	2.20
Maximum	10.66	10.31	10.33	10.36	10.55	10.65	10.55	10.66	10.53
Fixed asset tangibility, $\left(PPE/A\right)$									
Mean	0.26	0.30	0.36	0.29	0.29	0.24	0.25	0.25	0.23
Median	0.16	0.27	0.35	0.24	0.22	0.15	0.13	0.13	0.11
SD	0.32	0.25	0.23	0.29	0.33	0.26	0.39	0.34	0.29
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	6.87	1.13	1.23	2.18	3.54	1.81	6.87	3.75	3.41
Profitability, $\left(EBITDA/A\right)$									
Mean	-0.09	0.11	0.10	-0.02	-0.01	-0.13	-0.08	-0.17	-0.14
Median	0.05	0.13	0.12	0.07	0.06	0.01	0.02	0.03	0.03
SD	0.93	0.14	0.18	0.36	0.36	0.58	1.45	0.96	1.15
Minimum	-28.82	-0.62	-1.23	-4.89	-3.64	-6.98	-9.51	-16.85	-28.82
Maximum	34.00	0.39	0.60	0.64	3.00	3.38	34.00	7.16	2.01
Newly retained profit, $\Delta RE/A$									
Mean	-0.20	0.01	-0.07	-0.13	-0.29	-0.36	-0.17	-0.13	-0.19
Median	-0.02	0.01	0.01	-0.02	-0.03	-0.04	-0.02	-0.01	-0.03
SD	1.97	0.28	0.33	0.60	1.17	3.68	1.37	2.30	1.17
Minimum	-71.50	-1.29	-2.36	-7.24	-16.21	-71.50	-8.37	-35.58	-17.59
Maximum	45.87	1.81	0.08	4.63	7.60	32.22	24.98	45.87	11.88

Descriptive statistics for the unfiltered data results are supportive of the existence of market timing (reported in Table 5.2 Panel A). They show a decreasing pattern in the market leverage, decreasing from 1998 to 2005 (except in 2001). In contrast, book value of leverage exhibits a sharp decrease from 2003 to 2005. This reflects the effect of outliers in the data. For example, the maximum value of book leverage is 667.6 and 573.8, in years 2003 and 2004 respectively, compared to the maximum value recorded in 1998-2002[12] of 12.5. Two other interesting results are also noted here for net debt and net equity issues. There is a sharp debt reduction and a decrease in equity issues recorded in 2002 however, there is a subsequent increase in equity issues from 2002 to 2005 suggestive of market timing as this follows the

[12] See Table 5.2 Panel A.

bull market period from 2002 through to 2006. Figure 5.1, detailing the increase in the Australian share market value, support the variation recorded in the data set especially from the period 1999-2004, particularly the growth from 2003 onwards.

Figure 5.1: S&P/ASX 300 Price Index



Source: DataStream (Thompson Reuters)

Table 5.2 Panel B is based on the Baker and Wurgler (2002) filtered data. The Baker and Wurgler (2002) filtered data has some restrictions that may not be appropriate in an Australian context, especially the exclusion of firm year observations when the book value of assets falls below $10 million. By restricting the sample using this assumption a large number of firms are dropped because many Australian listed firms are relatively small in terms of their book value of assets. The result shows that net debt issues and net equity issues tend to exhibit similar trends over the study period. In particular net debt and net equity issues both increase after 2003. Baker and Wurgler's (2002) US based results are consistent with these results. A decrease in market leverage and an increase in market valuation (M/B ratio) prevail over this period. The increase in equity issues from 2003 suggests the possibility of market timing. Book leverage tends to decrease throughout the period.

Finally, the data set is further refined using a four standard deviation filter. Descriptive statistics for the four standard deviation filtered data are reported in Panel

C, Table 5.2. The results from the four standard deviation filtered data are also suggestive of market timing which shows a decrease in market leverage over the 9 year period and an increase in equity issues and a decrease in retained earnings over the bull market period, 2003-2005.

In summary, the bull period from 2003 to 2005, provides some evidence of market timing at the aggregate market level. It is important now to extend the analysis to variation across the panel data used in this study.

5.3 RESULTS

For the purpose of the analysis both pooled ordinary least squares regression (OLS) and fixed effect panel data analysis is used to test the market timing hypothesis that leverage is negatively correlated with past market value.

5.3.1 Determinants of annual changes in leverage

In this section the relationship between market-to-book and annual changes in leverage is documented. The change in leverage is then decomposed into three components: net equity issues, newly retained profit and growth in assets, following Baker and Wurgler (2002), to examine whether the market-to-book effect on observed leverage comes from net equity issues as market timing implies using equation 3.3.

5.3.1.1 Baker and Wurgler (2002) filtered data

Discussion in this section is primarily based on the Baker and Wurgler (2002) filtered data. The net effect of the market-to-book ratio on changes in leverage is apparent in summary statistics reported in Table 5.2, where leverage fell over the period while market-to-book tended to rise over the later part of the sample period. Though this suggests the existence of equity market timing, the effect of market-to-book ratio on changes in leverage is not proven. For instance, firms with high market-to-book ratio may decide to issue both debt and equity. Thus, in the analysis that follows the change in leverage is regressed on market-to-book as well as the control variables to assess

the impact of the alternative hypotheses on Australian firm leverage using equation 3.3.

Though primary focus is on the market-to-book ratio, three additional control variables are included in the equation that may be correlated with leverage (Baker & Wurgler 2002; Fama & French 2002; Fama & MacBeth 1973; Rajan & Zingales 1995). These variables are fixed asset tangibility, profitability and firm size. Asset tangibility is the ratio of net plant, property and equipment to total assets. Tangible assets may be used as collateral and so the expected relationship between fixed asset tangibility and changes in leverage is positive. In contrast, profitability is defined as earnings before interest, taxes, depreciation and amortization and this approximates the availability of internal funds. This is negatively related with leverage under the pecking order theory. As large firms are less likely to face financial distress, size is expected to be positively related with leverage (Baker & Wurgler 2002). Total revenue is used as a proxy for firm size. The last variable, lagged leverage is included in the model to remain consistent with Baker and Wurgler (2002)[13]. Lagged leverage often enters the analysis with a negative sign and this is consistent with the tendency for leverage to revert toward a long run equilibrium value over time.

Each of the variables included in this model (3.3) is defined in the Appendix A5.1 and also discussed in chapter 3. Pooled regression is run over the 981 companies for the period, 1997 to 2005, as well as for 3-year sub periods. Results of this analysis are reported in Table 5.3, Panel A, and they are consistent with Baker and Wurgler (2002) and with theoretical priors (Marsh, 1982). Market-to-book is negatively related with leverage using both the pooled OLS and the fixed effect specification in the full period analysis though there is some variation in the sub-period analyses[14]. Asset tangibility is generally positively related with leverage. Profitability is generally negatively related with leverage. Leverage also tends to increase with firm size.

[13] See Baker and Wurgler (2002).
[14] See the result of 1997-1999 in Panel A Table 5.3.

Table 5.3: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods)

Annual changes in book leverage and its components with respect to market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Book value of leverage is defined as book debt to assets $\left(\frac{D}{A}\right)_t$ at time t. The market-to-book ratio $\left(\frac{M}{B}\right)$ is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility $\left(\frac{PPE}{A}\right)$ is defined as net property, plant and equipment divided by assets. Profitability $\left(\frac{EBITDA}{A}\right)$ is defined as operating income before interest, taxes, depreciation and amortization divided by total assets. Firm size is defined as the log of total revenue, ($Log(S)_{t-1}$). The explanatory variables are measured at time, t-1. Panel A reports the annual change in leverage. The effect of net equity issues is reported in panel B where net equity issues, $\left(\frac{e_t}{A_t}\right)$ is defined as the change in book equity minus the change in retained earnings divided by assets. The newly retained earnings, $\left(\frac{\Delta RE_t}{A_t}\right)$ defined as the change in retained earnings divided by assets (See Panel C). Finally, panel D reports the components of residual change in leverage $E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)$ that depend on the total growth in assets[15]. Robust *t*-statistics are reported in parentheses.

[15] The total growth in assets is the combination of net equity issues, net debt issues and newly retained earnings

Table 5.3: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods) (continued)

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*T(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$												
Pooled (OLS)												
1997-2005	3612	-0.004	(-1.81)	0.007	(1.40)	-0.019	(-0.82)	0.011	(5.46)	-0.186	(-15.70)	0.08
1997-1999	474	0.001	(0.76)	-0.008	(-1.31)	-0.040	(-0.83)	0.005	(1.03)	-0.153	(-13.76)	0.07
2000-2002	1475	-0.006	(-3.32)	0.017	(2.23)	-0.020	(-0.88)	0.015	(12.78)	-0.211	(-8.80)	0.10
2003-2005	1663	-0.001	(-0.40)	0.010	(7.53)	-0.027	(-1.51)	0.010	(2.75)	-0.183	(-23.92)	0.08
Fixed effects												
1997-2005	3612	-0.003	(-1.54)	0.007	(1.58)	-0.027	(-1.25)	0.012	(6.55)	-0.193	(-11.49)	0.28
1997-1999	474	-0.023	(-2.80)	0.056	(1.06)	-0.032	(-0.40)	-0.005	(-0.74)	-0.118	(-7.82)	0.75
2000-2002	1475	-0.003	(-1.09)	0.029	(4.39)	0.041	(1.01)	0.013	(1.81)	-0.214	(-5.93)	0.63
2003-2005	1663	0.001	(0.64)	0.009	(8.14)	-0.039	(-2.12)	0.015	(5.40)	-0.188	(-8.47)	0.56
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$												
Pooled OLS												
1997-2005	3612	-0.049	(-6.40)	-0.008	(-0.85)	0.105	(1.92)	0.040	(6.21)	-0.134	(-2.22)	0.02
1997-1999	474	-0.018	(-1.36)	-0.0003	(-0.03)	-0.237	(-2.45)	0.019	(1.40)	0.006	(0.12)	0.02
2000-2002	1475	-0.053	(-5.37)	-0.042	(-1.93)	0.123	(1.26)	0.039	(4.67)	-0.019	(-0.44)	0.12
2003-2005	1663	-0.051	(-6.92)	-0.006	(-0.50)	0.124	(1.23)	0.045	(8.40)	-0.269	(-2.96)	0.01
Fixed effects												
1997-2005	3612	-0.044	(-7.89)	-0.012	(-1.12)	0.102	(2.14)	0.047	(7.06)	-0.169	(-2.29)	0.21
1997-1999	474	-0.108	(-2.69)	-0.221	(-5.77)	0.069	(4.24)	0.061	(1.52)	0.046	(0.35)	0.74
2000-2002	1475	-0.053	(-3.56)	-0.017	(-0.63)	0.107	(0.87)	0.067	(19.44)	-0.094	(-1.92)	0.61
2003-2005	1663	-0.060	(-5.34)	0.002	(0.28)	0.124	(1.50)	0.098	(3.27)	-0.588	(-2.47)	0.51

Table 5.3: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods) (continued)

Different Estimates	N	M/B_{t-1} b	$t(b)$	PPE/A_{t-1} c	$t(c)$	$EBITDA/A_{t-1}$ d	$t(d)$	$Log(S)_{t-1}$ e	$t(e)$	$(D/A)_{t-1}$ f	$t(f)$	R^2
Panel C: Changes in Book Leverage through Newly Retained Profits $\left(-\left(\Delta RE / A_t\right)\right)$												
Pooled OLS												
1997-2005	3612	-0.005	(-0.62)	-0.001	(-1.12)	0.076	(1.95)	-0.007	(-0.81)	-0.067	(-0.87)	0.001
1997-1999	474	-0.010	(-0.27)	0.018	(0.81)	-0.049	(-0.26)	-0.031	(-2.55)	0.028	(0.46)	0.02
2000-2002	1475	-0.008	(-0.81)	-0.004	(-21.21)	0.118	(2.48)	-0.013	(-1.19)	-0.026	(-2.11)	0.01
2003-2005	1663	0.002	(0.83)	0.003	(1.76)	0.040	(0.98)	0.006	(0.30)	-0.143	(-1.05)	0.002
Fixed effects												
1997-2005	3612	-0.009	(-1.02)	-0.002	(-0.89)	0.085	(2.43)	-0.004	(-0.35)	-0.061	(-0.77)	0.29
1997-1999	474	0.007	(0.26)	0.113	(0.66)	-0.294	(-0.82)	0.017	(0.43)	-0.158	(-0.96)	0.98
2000-2002	1475	0.013	(1.17)	0.003	(4.86)	0.077	(1.71)	-0.003	(-0.11)	0.044	(2.34)	0.88
2003-2005	1663	0.015	(1.27)	-0.003	(-1.13)	0.034	(0.67)	0.037	(2.21)	-0.300	(-1.79)	0.63
Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$												
Pooled OLS												
1997-2005	3612	0.032	(3.50)	0.017	(1.25)	0.147	(2.84)	-0.016	(-2.58)	0.057	(1.35)	0.01
1997-1999	474	0.033	(1.95)	-0.008	(-0.55)	0.136	(1.12)	-0.001	(-0.12)	-0.002	(-0.04)	0.04
2000-2002	1475	0.036	(2.51)	0.196	(8.23)	0.172	(2.37)	-0.020	(-4.40)	0.100	(1.96)	0.01
2003-2005	1663	0.031	(6.02)	0.005	(0.78)	0.096	(1.36)	-0.022	(-3.06)	0.018	(0.25)	0.01
Fixed effects												
1997-2005	3612	0.040	(2.29)	0.013	(1.10)	0.115	(1.56)	-0.014	(-1.24)	0.008	(0.15)	0.20
1997-1999	474	0.006	(0.21)	0.137	(3.03)	0.268	(5.03)	-0.004	(-0.09)	-0.023	(-0.48)	0.75
2000-2002	1475	0.013	(0.85)	0.084	(7.26)	0.229	(4.42)	-0.023	(-1.33)	0.088	(1.21)	0.65
2003-2005	1663	0.024	(5.08)	-0.005	(-1.20)	0.104	(2.98)	-0.019	(-0.89)	-0.124	(-3.14)	0.40

Using pooled OLS estimates over the full period, 1997-2005, a one standard deviation increase in market-to-book is associated with a 0.44 percent decrease in leverage. This is consistent with the idea that firm will increase equity when market valuation is high but this could also result from a decrease in debt or an increase in retained earnings. The other columns of Panel A Table 5.3 show that fixed asset tangibility tends to increase leverage by 0.44 percent for a one standard deviation increase, profitability tends to reduce leverage by 0.34 percent for a one standard deviation increase and firm size tends to increase leverage by 1.34 percent for a one standard deviation increase[16].

There is evidence that when market valuation is high firms tend to issue equity and thus decrease leverage and this is consistent with market timing. Similar results are obtained when using 3-year sub periods though the level of significance and the parameter signs vary somewhat (Table 5.3, Panel A). Other results are broadly in line with the Baker and Wurgler (2002) and supportive of the pecking order theory.

Then, using equation 3.4, the change in leverage is decomposed into three components: net equity issues, newly retained earnings and the residual changes in leverage (also known as total growth in assets) to focus on the actual sources of change (equity issues, retained earnings and asset growth). That is the question whether the effect of market-to-book ratio comes through net equity issues is addressed here. The decomposition is shown in chapter 3. Panel B, C and D of Table 5.3 present the results for the Baker and Wurgler (2002) filtered data set when each of these three components of changes in leverage is regressed on market-to-book ratio and the other independent variables.

Decomposition results in Panel B of Table 5.3 illustrate that market-to-book is negatively related with net equity issues (note that the dependent variable has a negative sign) using both pooled OLS and the fixed effect specification, suggesting that higher valuation in the market leads to the issue of equity (Marsh, 1982). There is a statistically insignificant relationship between market-to-book and retained earnings as can be seen from Panel C and pooled OLS estimation shows statistically

[16] -0.44 = -0.004 * 1.10 where 1.10 is the standard deviation of lagged market-to-book ratio. 0.44 = .007 * 0.63 where 0.63 is the standard deviation of lagged asset tangibility. 0.34 = -0.020 * 0.17 where 0.20 is the standard deviation of lagged profitability. 1.34 = 0.011 * 1.22 where 1.22 is the standard deviation of lagged firm size.

insignificant positive coefficients in the later sub periods, particularly in 2003-2005 (Table 5.3, Panel C). So, the possibility that market-to-book affects leverage because it might be used to predict earnings is not supported. From Panel D it is apparent that market-to-book is positively related with growth in assets. Hence, the study finds that market-to-book effects leverage through net equity issues and asset growth.

In Table 5.3, Panel A, it also appears that profitability reduces leverage, though the coefficients are rarely statistically significant. This relationship between profitability and leverage may explained by the availability of retained earnings rather than fresh issues of equity (Myers & Majluf 1984). This finding supports the pecking order theory in line with the previous literatures (Allen 1993; Gatward & Sharpe 1996; Chiarella et al. 1992). The remaining coefficients are broadly consistent with those reported in Baker and Wurgler (2002).

5.3.1.2 Unfiltered data

The market timing hypothesis results for the unfiltered data reported in Table 5.4 are similar to the Baker and Wurgler (2002) results. Panel A of Table 5.4 using full period analysis shows that the market-to-book ratio is statistically significant and negatively related with leverage. This suggests the existence of market timing. The sub-period analysis results are also similar to the full period result except for the early sub-period, though the coefficients are rarely statistically significant. From Panel B of Table 5.4 it is apparent that in general higher market-to-book ratio is associated with higher net equity issues (note that the dependent variable has a negative sign). But the results in Panel C and Panel D of Table 5.4 are somewhat different from the findings of Baker and Wurgler (2002) filtered data results (Table 5.3). The full period and the later sub-period analysis of Panel C and D show that the market-to-book ratio has a negative relationship with retained earnings and growth in assets, indicating market-to-book effects leverage through forecast earnings. There is also considerable variation in coefficient sign and significance for the remaining explanatory variables. This variation in results could be due to the impact of outliers. Analysis of a four standard deviation filtered data set is provided next to further explore this issue.

Table 5.4: Unfiltered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods)

Analysis of annual change in book leverage and its components with respect to market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using unfiltered data.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Book value of leverage is defined as book debt to assets at time t. The market-to-book ratio is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility is defined as net property, plant and equipment divided by assets. Profitability is defined as operating income before interest, taxes, depreciation and amortization divided by total assets. Firm size is defined as the log of total revenue. The explanatory variables are measured at time, t-1. Panel A reports the annual change in leverage. Effect of net equity issues is reported in panel B where net equity issues is defined as the change in book equity minus the change in retained earnings divided by assets. The newly retained earnings component is reported in Panel C and it is defined as the change in retained earnings divided by assets. Finally, panel D reports the components of residual change in leverage that depend on the total growth in assets[17]. Robust *t*-statistics are reported in parentheses.

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*C*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$												
Pooled OLS												
1997-2005	4939	-0.787	(-7.96)	-0.019	(-2.35)	-0.627	(-9.02)	-0.484	(-2.49)	0.058	(0.42)	0.52
1997-1999	500	-0.001	(-0.11)	-0.014	(-4.70)	0.024	(0.65)	0.004	(0.83)	-0.143	(-5.34)	0.07
2000-2002	1884	-0.006	(-2.51)	0.0002	(0.23)	0.002	(1.77)	0.019	(3.01)	-0.279	(-5.17)	0.05
2003-2005	2555	-0.933	(-18.11)	-0.044	-(2.75)	-0.682	(-88.02)	-0.813	(-3.35)	0.226	(2.51)	0.53
Fixed effects												
1997-2005	4939	-0.792	(-8.28)	-0.003	(-0.28)	-0.622	(-10.13)	-0.490	(-2.16)	0.063	(0.48)	0.60
1997-1999	500	-0.007	(-2.17)	-0.011	(-0.95)	0.012	(0.14)	0.013	(0.54)	-0.247	(-3.63)	0.84
2000-2002	1884	-0.002	(-1.27)	0.001	(3.78)	0.003	(75.14)	0.014	(1.26)	-0.253	(-2.73)	0.55
2003-2005	2555	-0.913	(-64.90)	-0.034	(-9.61)	-0.679	(-19.67)	-0.839	(-3.27)	0.198	(5.62)	0.76

[17] The total growth in assets is the combination of net equity issues, net debt issues and newly retained earnings

Table 5.4: Unfiltered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods) (Continued)

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*C*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$												
Pooled OLS												
1997-2005	4939	-0.019	(-5.02)	-0.002	(-0.88)	-0.005	(-2.21)	0.075	(5.94)	0.021	(4.52)	0.02
1997-1999	500	-0.030	(-4.78)	-0.001	(-0.09)	-0.087	(-0.77)	0.025	(1.79)	-0.034	(-4.76)	0.06
2000-2002	1884	-0.014	(-0.57)	-0.002	(-1.48)	0.0004	(0.09)	0.069	(3.65)	0.028	(0.15)	0.01
2003-2005	2555	-0.020	(-4.03)	-0.001	(-0.92)	-0.005	(-7.32)	0.084	(5.27)	0.022	(3.05)	0.03
Fixed effects												
1997-2005	4939	-0.019	(-4.42)	-0.003	(-1.29)	-0.005	(-2.10)	0.073	(5.87)	0.022	(4.91)	0.21
1997-1999	500	-0.018	(-0.72)	0.009	(0.52)	0.068	(0.47)	0.028	(1.69)	0.077	(0.48)	0.80
2000-2002	1884	-0.005	(-0.23)	0.002	(1.14)	-0.001	(-0.48)	0.050	(4.75)	0.218	(1.04)	0.62
2003-2005	2555	-0.021	(-7.60)	-0.001	(-0.66)	-0.005	(-5.11)	0.096	(7.48)	0.024	(7.63)	0.55
Panel C: Change in leverage through Newly Retained Profits $(-(\Delta RE/A_t))$												
Pooled OLS												
1997-2005	4939	-0.182	(-7.10)	-0.022	(-1.17)	-0.136	(-9.08)	-0.596	(-2.18)	0.224	(8.36)	0.01
1997-1999	500	0.011	(1.42)	-0.005	(-0.54)	-0.363	(-1.85)	-0.020	(-2.35)	-0.174	(-2.54)	0.10
2000-2002	1884	-0.023	(-0.57)	0.002	(0.66)	-0.002	(-0.96)	-0.089	(-15.8)	-0.473	(-2.32)	0.01
2003-2005	2555	-0.217	(-12.29)	-0.075	(-1.24)	-0.149	(-20.02)	-0.959	(-2.74)	0.264	(12.19)	0.01
Fixed effects												
1997-2005	4939	-0.178	(-7.32)	-0.003	(-0.23)	-0.135	(-10.18)	-0.634	(-1.98)	0.218	(6.97)	0.18
1997-1999	500	-0.010	(-0.31)	-0.031	(-1.27)	-0.744	(-1.17)	-0.016	(-0.34)	-0.607	(-2.36)	0.78
2000-2002	1884	-0.017	(-0.75)	-0.011	(-3.03)	-0.004	(-1.82)	-0.107	(-7.56)	-0.714	(-2.19)	0.46
2003-2005	2555	-0.196	(-28.78)	-0.052	(-1.57)	-0.145	(-13.24)	-1.036	(-3.04)	0.235	(26.01)	0.51

Table 5.4: Unfiltered data: Determinants of change in book leverage and components (Full period and 3 year sub-periods) (Continued)

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel D: Changes in Book Leverage through Growth in Assets $\left(-E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right)$												
Pooled OLS												
1997-2005	4939	-0.586	(-6.32)	0.005	(0.34)	-0.486	(-8.11)	0.036	(0.30)	-0.187	(-1.45)	0.68
1997-1999	500	0.018	(3.37)	-0.009	(-0.72)	0.481	(5.67)	-0.002	(-0.27)	0.058	(1.28)	0.10
2000-2002	1884	0.031	(2.31)	0.001	(0.15)	0.004	(1.30)	0.039	(4.80)	0.166	(2.40)	0.00
2003-2005	2555	-0.696	(-9.40)	0.032	(0.70)	-0.529	(-41.01)	0.062	(0.36)	-0.059	(-0.53)	0.69
Fixed effects												
1997-2005	4939	-0.596	(-6.60)	0.003	(0.36)	-0.482	(-9.16)	0.072	(0.49)	-0.178	(-1.43)	0.74
1997-1999	500	0.020	(1.64)	0.011	(0.97)	0.687	(1.59)	0.001	(0.06)	0.282	(3.29)	0.74
2000-2002	1884	0.019	(6.41)	0.011	(3.89)	0.009	(5.54)	0.071	(2.73)	0.242	(1.33)	0.47
2003-2005	2555	-0.695	(-29.70)	0.020	(0.61)	-0.529	(-20.56)	0.101	(1.10)	-0.060	(-1.83)	0.85

5.3.1.3 Four Standard Deviation filtered data

When simple four standard deviation filtered data is selected (reported in Table 5.5, Panel A) the full period results indicate an insignificant relationship between market-to-book and leverage using pooled OLS and the fixed effect specification. This result is not consistent with the findings of Baker and Wurgler (2002). One result worth noting is that firm size plays an important role, exhibiting a significant positive relationship with leverage for the full sample. Sub period analysis suggests that the variation in estimated market to book coefficient is explained by the sub period 2003-2005 results. Decomposition results in Panel B, C and D of Table 5.5 generally show similar findings as to those of Baker and Wurgler (2002) in terms of testing the market timing hypothesis. Generally, Table 5.5 supports the argument that market-to-book effects leverage through net equity issues and asset growth. Further discussion is provided in section 5.4.

Table 5.5: Four Standard Deviation filtered data: Determinants of changes in book leverage and components (Full period and 3 year sub-periods)

Analysis of annual change in book leverage and its components with respect to market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using four standard deviation filtered data. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Book value of leverage is defined as book debt to assets at time t. The market-to-book ratio is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility is defined as net property, plant and equipment divided by assets. Profitability is defined as operating income before interest, taxes, depreciation and amortization divided by total assets. Firm size is defined as the log of total revenue. The explanatory variables are measured at time, t-1. Panel A reports the annual change in leverage. Effect of net equity issues is reported in panel B where net equity issues is defined as the change in book equity minus the change in retained earnings divided by assets. The newly retained earnings component is reported in Panel C and it is defined as the change in retained earnings divided by assets. Finally, panel D reports the components of residual change in leverage that depend on the total growth in assets[18]. Robust *t*-statistics are reported in parentheses.

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*C*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$												
Pooled OLS												
1997-2005	4681	0.001	(0.10)	0.042	(1.51)	0.020	(0.03)	0.037	(2.91)	-0.519	(-4.40)	0.25
1997-1999	264	-0.003	(-0.69)	0.009	(0.27)	0.070	(0.62)	0.001	(0.26)	-0.249	(-4.49)	0.15
2000-2002	1876	-0.004	(-1.18)	0.088	(1.87)	0.035	(1.03)	0.009	(0.69)	-0.280	(-10.93)	0.06
2003-2005	2541	0.005	(2.20)	0.003	(0.25)	0.017	(0.48)	0.046	(3.71)	-0.582	(-6.22)	0.34
Fixed effects												
1997-2005	4681	0.001	(0.25)	0.042	(2.06)	0.020	(0.83)	0.041	(3.41)	-0.520	(-4.51)	0.38
1997-1999	264	-0.005	(-0.71)	-0.002	(-0.01)	0.161	(0.44)	0.023	(1.03)	-0.461	(-1.19)	0.81
2000-2002	1876	0.0003	(0.08)	0.065	(1.62)	0.050	(2.28)	0.001	(0.15)	-0.299	(-6.47)	0.53
2003-2005	2541	0.003	(0.74)	-0.004	(-0.47)	0.015	(1.33)	0.045	(4.68)	-0.562	(-7.13)	0.62

[18] The total growth in assets is the combination of net equity issues, net debt issues and newly retained earnings

Table 5.5: Four Standard Deviation filtered data: Determinants of changes in book leverage and components (Full period and 3 year sub-periods) (continued)

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*C*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel B: Change in leverage through Net Equity Issues $(-e/A_t)$												
Pooled OLS												
1997-2005	4681	-0.041	(-4.07)	-0.088	(-1.77)	0.051	(2.06)	0.057	(4.72)	0.077	(0.46)	0.03
1997-1999	264	-0.034	(-3.09)	-0.097	(-1.49)	-0.020	(-0.23)	0.022	(5.41)	-0.125	(-1.37)	0.13
2000-2002	1876	-0.015	(-1.58)	-0.137	(-1.34)	-0.012	(-0.03)	0.079	(2.65)	0.040	(0.22)	0.01
2003-2005	2541	-0.062	(-8.42)	-0.052	(-0.86)	0.051	(3.38)	0.049	(2.27)	0.108	(0.48)	0.05
Fixed effects												
1997-2005	4681	-0.036	(-4.58)	-0.059	(-1.08)	0.051	(2.10)	0.052	(5.21)	0.069	(0.45)	0.19
1997-1999	264	-0.051	(-0.82)	-0.226	(-0.71)	0.156	(0.23)	-0.047	(-0.26)	-0.152	(-0.17)	0.74
2000-2002	1876	-0.004	(-0.40)	-0.122	(-1.64)	-0.162	(-0.48)	0.066	(2.13)	0.060	(0.45)	0.43
2003-2005	2541	-0.062	(-8.28)	-0.082	(-7.86)	0.032	(1.62)	0.062	(3.98)	0.027	(0.21)	0.44
Panel C: Change in leverage through Newly Retained Profits $(-(\Delta RE/A_t))$												
Pooled OLS												
1997-2005	4681	0.015	(1.30)	0.049	(0.90)	-0.135	(-3.41)	-0.032	(-1.26)	-0.724	(-2.58)	0.03
1997-1999	264	0.006	(0.70)	0.032	(0.92)	-0.489	(-3.56)	-0.021	(-1.29)	-0.309	(-2.74)	0.19
2000-2002	1876	-0.030	(-3.31)	-0.042	(-0.35)	-0.154	(-0.60)	-0.067	(-4.23)	-0.508	(-1.66)	0.01
2003-2005	2541	0.048	(2.35)	0.065	(0.80)	-0.127	(-5.01)	-0.006	(-0.17)	-0.803	(-3.29)	0.07
Fixed effects												
1997-2005	4681	0.015	(1.41)	0.036	(0.63)	-0.127	(-3.41)	-0.023	(-0.83)	-0.726	(-2.91)	0.19
1997-1999	264	0.122	(-0.52)	-0.107	(1.23)	-1.365	(-0.25)	0.093	(-3.55)	-0.622	(0.57)	0.73
2000-2002	1876	-0.033	(-1.96)	-0.238	(-1.14)	-0.100	(-0.40)	-0.049	(-6.66)	-0.715	(-2.96)	0.46
2003-2005	2541	0.050	(2.96)	0.120	(1.56)	-0.097	(-4.32)	-0.012	(-0.65)	-0.693	(-3.94)	0.47

Table 5.5: Four Standard Deviation filtered data: Determinants of changes in book leverage and components (Full period and 3 year sub-periods) (continued)

		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*C*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel D: Changes in Book Leverage through Growth in Assets $\left(-E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right)$												
Pooled OLS												
1997-2005	4681	0.027	(4.14)	0.081	(1.91)	0.104	(6.22)	0.011	(0.68)	0.128	(1.70)	0.01
1997-1999	264	0.025	(2.38)	0.069	(11.23)	0.582	(3.65)	-0.002	(-0.16)	0.173	(1.33)	0.18
2000-2002	1876	0.042	(22.27)	0.267	(4.20)	0.201	(2.74)	-0.003	(-0.14)	0.188	(1.45)	0.01
2003-2005	2541	0.020	(1.55)	-0.011	(-0.10)	0.093	(10.31)	0.003	(0.16)	0.114	(1.04)	0.01
Fixed effects												
1997-2005	4681	0.023	(3.90)	0.064	(1.23)	0.096	(5.97)	0.012	(0.50)	0.137	(2.22)	0.17
1997-1999	264	-0.076	(-0.92)	0.331	(1.95)	1.371	(1.95)	-0.023	(-0.27)	0.314	(0.44)	0.82
2000-2002	1876	0.037	(9.35)	0.425	(2.57)	0.313	(5.03)	-0.016	(-0.70)	0.356	(2.75)	0.46
2003-2005	2541	0.016	(1.81)	-0.042	(-0.44)	0.080	(13.92)	-0.005	(-0.28)	0.104	(1.02)	0.39

5.3.2 EFWAMB and capital structure

So far it has been observed that the effect of market-to-book on leverage comes through net equity issues as market timing implies. However, market timing may have a persistent impact and explains firm leverage, if managers do not rebalance to some target leverage ratio and thus, past market valuation may help our understanding of the variation in leverage. In this section, leverage is regressed on external finance weighted average market-to-book ratio (EFWAMB) to address the question of whether the effect of market-to-book ratio on leverage is persistent. EFWAMB is used as a proxy for past equity market timing and it is defined in chapter 3 (equation 3.5).

5.3.2.1 Baker and Wurgler (2002) filtered data

Following Baker and Wurgler (2002) firm year observations are dropped when EFWAMB exceeds 10. And the equation used in the analysis with EFWAMB is 3.6[19] for the period from 1997 to 2005 (Table 5.6).

Baker and Wurgler (2002) contend that there is a negative relationship between EFWAMB and leverage. Essentially a relatively high market-to-book ratio leads to equity issues and thus induces a negative relationship between market-to-book ratio and leverage (Hovakimian 2006). Table 5.6 shows the results from the analysis using the weighted average market-to-book ratio and the other four control variables that were included in previous regressions (Fama & French 2002; Frank & Goyal 2003; Rajan & Zingales 1995).

[19] Refer to chapter 3

Table 5.6: Baker and Wurgler (2002) filtered data: Determinants of leverage (For the period, 1997-2005)

Book leverage and market leverage with respect to the market-to-book ratio, fixed assets, profitability and firm size for the full period, 1997 to 2005. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Leverage, $\left(\frac{D}{A}\right)_t$ is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. The market-to-book ratio $\left(\frac{M}{B}\right)$ is also defined in two ways. The first one is weighted average market-to-book ratio from the year 1997 to year t-1. And the second is the market-to-book ratio in year t-1, which is defined as assets minus book equity plus market equity all divided by assets. Fixed assets tangibility $\left(\frac{PPE}{A}\right)$, is defined as net property, plant and equipment divided by assets. Profitability $\left(\frac{EBITDA}{A}\right)$ is defined as operating income before interest, taxes, depreciation and amortization. Firm size is defined as the log of total revenue $Log(S)$, which is the proxy for firm size. The explanatory variables are measured at time, t-1. The study drop firm year observations where external finance weighted average market-to-book ratio or $(EFWAMB)$ exceeds 10. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

Table 5.6: Baker and Wurgler (2002) filtered data: Determinants of leverage (For the period, 1997-2005) (continued)

		$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*N**	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage												
Pooled OLS	3595	-0.008	(-4.05)	-0.007	(-2.86)	0.024	(2.35)	-0.025	(-1.24)	0.094	(30.49)	0.28
Fixed effects	3595	0.0003	(0.11)	-0.008	(-2.71)	0.027	(3.15)	-0.036	(-1.22)	0.092	(23.66)	0.45
Panel B: Market Leverage												
Pooled OLS	3595	-0.018	(-9.25)	-0.076	(-16.21)	0.023	(2.26)	-0.080	(-3.85)	0.069	(24.77)	0.30
Fixed effects	3595	-0.007	(-5.45)	-0.079	(-19.65)	0.024	(2.64)	-0.081	(-2.53)	0.068	(17.37)	0.48

* If $(EFWAMB)_t$ >10, firm year observations dropped from 3612 to 3595.

The results in Table 5.6 are consistent with Baker and Wurgler (2002)[20]. The EFWAMB variable is more strongly correlated with book leverage than the market-to-book ratio ($(M/B)_{t-1}$) with one exception. However, market-to-book exhibits a more significant negative relationship with market leverage than the EFWAMB. For example, Table 5.6, using pooled ordinary least squares estimates suggests a 1.00 and a 2.23 percentage point decrease in book leverage and market leverage respectively per one standard deviation increase in EFWAMB[21]. On the other hand the coefficient suggests a 0.77 and a 8.36 percentage point decrease in book leverage and market leverage respectively per one standard deviation increase in market-to-book[22]. Further, a one standard deviation increase in firm size is associated with 11.47 percentage point increase in book leverage and 8.42 percentage point increase in market leverage[23] Overall the results of Table 5.6 show that EFWAMB and market-to-book are both important in explaining the variation in leverage as well as firm size. This is not supportive of Baker and Wurgler's (2002) argument. They contend that the EFWAMB is the single most important economic variable explaining the cross sectional variation in leverage compared to other variables. These overall results could be interpreted as suggesting that though EFWAMB exhibit a significant negative relationship with leverage, this is not the single most important economic variable to explain the variation in leverage.

5.3.2.2 Unfiltered data

Analysis of the unfiltered data, reported in Table 5.7, indicates that EFWAMB is more important in explaining the variation in leverage than market-to-book ($(M/B)_{t-1}$), consistent with the Baker and Wurgler (2002), though the effect of past market-to-book is not statistically significant for book leverage. The other significant effect comes through firm size, where a one standard deviation increase is associated with an increase in market leverage of 11.85 percentage points (11.85 = 1.50 * 0.079 where 1.50 is the standard deviation of firm size).

[20] See Baker and Wurgler's (2002), Table III, p.16.
[21] For example: -1.00 = 1.24 * -0.008 and -2.23 = 1.24 * -0.018 where 1.24 is the standard deviation of EFWAMB. See Baker and Wurgler's (2002) comparative statics in page 17, footnote 10.
[22] For example: -0.77 = 1.10 * -0.007 and -8.36 = 1.10 * -0.076 where 1.10 is the standard deviation of lagged market-to-book
[23] For example: 11.47 = 1.22 * 0.094 and 8.42 = 1.22 * 0.069 where 1.22 is the standard deviation of lagged firm size

Table 5.7: Unfiltered data: Determinants of leverage (For the period, 1997-2005)

Book leverage and market leverage with respect to the market-to-book ratio, fixed assets, profitability and firm size for the full period, 1997 to 2005. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b\left(EFWAMB\right)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log\left(S\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Leverage is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. The market-to-book ratio is also defined in two ways. The first one is weighted average market-to-book ratio from the year 1997 to year t-1. And the second is the market-to-book ratio in year t-1, which is defined as assets minus book equity plus market equity all divided by assets. Fixed assets tangibility, is defined as net property, plant and equipment divided by assets. Profitability is defined as operating income before interest, taxes, depreciation and amortization. Firm size is defined as the log of total revenue which is the proxy for firm size. The explanatory variables are measured at time, t-1. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

		$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage												
Pooled OLS	4939	-0.049	(-1.51)	0.016	(0.88)	-0.007	(-0.99)	-0.436	(-1.89)	-0.155	(-0.81)	0.20
Fixed effects	4939	-0.056	(-1.64)	0.018	(0.96)	0.007	(0.98)	-0.413	(-2.01)	-0.201	(-0.84)	0.34
Panel B: Market Leverage												
Pooled OLS	4939	-0.005	(-2.29)	0.0003	(0.93)	0.004	(1.85)	-0.0001	(-0.03)	0.079	(63.02)	0.25
Fixed effects	4939	-0.003	(-1.88)	0.0002	(1.15)	0.006	(2.25)	-0.0002	(-0.37)	0.077	(42.69)	0.45

5.3.2.3 Four Standard Deviation filtered data

However, the analysis of the four standard deviation filtered data, reported in Table 5.8, shows that the market-to-book ($(M/B)_{t-1}$) has a stronger impact on leverage than the EFWAMB (past market-to-book) and both $(M/B)_{t-1}$ and EFWAMB exhibit a positive relationship with book leverage. $(M/B)_{t-1}$ reflects a significant negative relationship with market leverage. This result is not consistent with the hypothesis of market timing. Rather, it suggests that the effect of historical equity valuation on leverage may not be persistent.

5.4 DISCUSSION

5.4.1 Summary statistics and determinants of capital structure

Using the Baker and Wurgler filtered (2002) data for the period of 1997-2005, reported in Table 5.2, Panel B the study get similar results to those of Baker and Wurgler (2002). The Unfiltered data results (Table 5.2, Panel A) are supportive of the existence of market timing. They show a steady pattern in the market value of leverage, decreasing from 1998 to 2005 (except in 2001). Descriptive statistics for the four standard deviation filter results (Table 5.2, Panel C) are also suggestive of market timing. They show a decrease in market leverage, an increase in equity issues and a decrease in retained earnings.

Regression results with full period analysis based on the unfiltered data (reported in Table 5.4), suggest a negative relation between market-to-book and leverage. The study notes that tangible assets, profitability and firm size are also negatively correlated with leverage with significant economic impact. The impact of changes in market-to-book on leverage is substantial with, a one standard deviation increase in market-to-book associated with 15.61 percent decrease in leverage (-15.61 = 19.84 * -0.787 where 19.84 is the standard deviation of lagged market-to-book). Further, firm size is negatively related with leverage for this data set. There are considerable outlier problems with this data set, and so, perhaps these unexpected results are not surprising.

Table 5.8: Four Standard Deviation filtered data: Determinants of leverage (For the period, 1997-2005)

Book leverage and market leverage with respect to the market-to-book ratio, fixed assets, profitability and firm size for the full period, 1997 to 2005. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Leverage is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. The market-to-book ratio is also defined in two ways. The first one is weighted average market-to-book ratio from the year 1997 to year t-1. And the second is the market-to-book ratio in year t-1, which is defined as assets minus book equity plus market equity all divided by assets. Fixed assets tangibility, is defined as net property, plant and equipment divided by assets. Profitability is defined as operating income before interest, taxes, depreciation and amortization. Firm size is defined as the log of total revenue which is the proxy for firm size. The explanatory variables are measured at time, t-1. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

		$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
						Panel A: Book Leverage						
Pooled OLS	4681	0.002	(0.73)	0.014	(2.98)	0.080	(3.05)	-0.029	(-0.85)	0.084	(12.66)	0.08
Fixed effects	4681	0.003	(0.95)	0.014	(3.98)	0.78	(3.72)	-0.028	(-0.92)	0.088	(16.44)	0.23
						Panel B: Market Leverage						
Pooled OLS	4681	-0.003	(-1.27)	-0.014	(-7.22)	0.091	(8.86)	-0.008	(-1.78)	0.070	(39.05)	0.29
Fixed effects	4681	-0.0003	(-0.14)	-0.014	(-8.12)	0.086	(8.61)	-0.009	(-1.96)	0.071	(34.42)	0.44

The four standard deviation filtered data results are reported in Table 5.5 using the data for the period of 1997-2005 and 3-year sub periods. Panel A of Table 5.5 results, using the full period data, suggest that there is a negative relation between market-to-book and the change in leverage but with little economic impact. The 3-year sub period results exhibit similar trends to those of Baker and Wurgler (2002) except for the year 2003-2005[24]. The study also notes that tangible assets, profitability and firm size are generally correlated with leverage when using both the full period and the 3-year sub periods. The positive correlation between profitability and leverage suggests that a more profitable firm can take on more leverage. However, the results from the Panel B and C for the four standard deviation filtered data (Table 5.5) show that market-to-book is significantly negatively related with leverage (note the sign of the dependent variables) whereas there is a weak relationship between market-to-book and retained earnings. Further, the relationship between growth in assets and market-to-book is positive as expected under market timing (Panel D of Table 5.5). Thus, the results in Table 5.5 suggest that the market-to-book ratio operates through net equity issues as implied by market timing theory.

There are two general results to note with analysis of the Baker and Wurgler (2002) filtered data, unfiltered data and a four standard deviation filtered data. First, the effect of high market valuation is to lower leverage in the short run and second, the market-to-book ratio effect operates through net equity issues and asset growth, consistent with the findings of Baker and Wurgler (2002). These results are supportive of the theory of market timing (Baker & Wurgler 2002). Filter choice appears to have little impact on the results, particularly for the sign of the market-to-book coefficient in later sub periods.

5.4.2 External finance, market timing and capital structure

Baker and Wurgler (2002) and Hovakimian (2006) find that the relationship between external finance weighted average market-to-book (EFWAMB) and leverage is strong and robust. Baker and Wurgler (2002) argue that firms with a relatively high market-to-book ratio issue equity, consistent with market timing. Thus a negative relationship

[24] The increase in leverage with higher market-to-book ratio in this sub period may indicate that when market valuations are high the firm tends to increase debt rather than equity.

between EFWAMB and current leverage arises because of equity market timing. As firms that use market timing do not adjust their leverage towards a target leverage ratio, the past market-to-book ratio should have a long lasting negative effect on current capital structure.

When the Baker and Wurgler (2002) filtered data is used it is found that the variable EFWAMB generally has a significant negative effect on book leverage and market leverage (Table 5.6) and this is consistent with the market timing hypothesis. The exception is evident in the fixed effects model in Panel A of Table 5.6 where the coefficient is insignificant. Further, the results show that the past market-to-book is not the single most important factor to explain the variation in leverage. This result suggests that the effect of market timing in Australian firms is not as persistent as it is for US firms though the study finds that higher valuation in the market does result in equity issues. This supports the argument that a high market-to-book ratio is associated with debt reduction but the effect is not long lasting (Frank & Goyal 2004). As indicated above, the study also conducts analysis over the unfiltered data but there was little difference from the Baker and Wurgler (2002) filtered results.

When four standard deviation filtered data is used, the results change. It is evident from the Table 5.8 that the market-to-book ($(M/B)_{t-1}$) has a stronger impact on leverage than the EFWAMB where $(M/B)_{t-1}$ and EFWAMB both exhibit a positive relationship with book leverage. Yet, $(M/B)_{t-1}$ reflects a significant negative relationship with market leverage. This result is not consistent with the hypothesis that past market timing has a long lasting impact on leverage. Rather, it suggests that the effect of historical equity valuation on leverage may not be persistent.

These results provide some insight into the capital structure choice of Australian firms in the presence of market timing. The study finds that the market timing theory of Baker and Wurgler (2002) appears to provide one explanation for financial policy in Australia. However, the results are sensitive to the choice of sample and analysis method.

5.5 CONCLUSION

In a world of efficient capital markets the costs of different types of capital do not vary independently so there is no gain in shifting from debt to equity or vice versa (Modigliani and Miller 1958). There is a substantial literature at both a theoretical and an empirical level dealing with the determinants of capital structure.

The theory of market timing seems to have explanatory power over capital structure (Huang & Ritter 2005; Jenter 2005) in US studies. The literature dealing with the theory of market timing and capital structure choice using US firms is expanding. But little research has been conducted that takes an Australian perspective. Therefore, one major contribution of the study is that it considers a new data set and finds some support for the hypothesis that market timing appears to have an impact on the capital structure choice of Australian firms. Another contribution is that the study reveals that the results are sensitive to filter choice with variation in the strength of the negative relationship observed between past market-to-book and leverage.

In this analysis it has been tested whether market timing has an impact on capital structure using Australian data. Market-to-book ratio is used as a proxy for market value as perceived by managers. The study finds that the market-to-book ratio is negatively related to leverage in general and this suggests the existence of market timing. The study also document that this effect is explained by net equity issues, consistent with the theory of market timing. However, the results are sensitive to the data set and method used in the analysis. When the study uses the four standard deviation filter, the results suggest that firms issue debt rather than equity when market value is high. In addition, it is found that market-to-book has a strong and more significant impact on leverage than the external finance weighted average market-to-book, thus not supporting the hypothesis that past market-to-book explains the cross section variation in leverage (Baker & Wurgler 2002). Thus, with this data set while market timing appears to affect capital structure choice for Australian firms it does not support the hypothesis that past market timing decisions have a long lasting impact on Australian firm capital structure. This suggests that the market timing result may not be as robust as initially thought, consistent with some of the more recent literature.

CHAPTER 6

MARKET TIMING OR GROWTH OPPORTUNITIES

6.1 INTRODUCTION

It has been argued that, in the presence of frictions, firms adjust their capital structure occasionally. Thus the empirical evidence on capital structure is mixed (Hovakimian 2006). It has been observed that the debt ratio is related to firm size, growth opportunities, liquidity, and value of assets and this is consistent with the predictions of trade-off theories (Rajan & Zingales 1995; Titman & Wessels 1988). The studies that report the importance of target leverage as a determinant of debt/equity choice is also supportive of the trade-off hypothesis (Hovakimian, Opler & Titman 2001; Jalilvand & Harris 1984; Marsh 1982). On the other hand, the pecking order model generally outperforms the trade-off model in explaining the time series variation in leverage. As discussed in the previous chapter, Baker and Wurgler (2002) introduce a theory of market timing to explain observed corporate capital structure. They conclude that capital structure is the cumulative outcome of past attempts at equity market timing and there is some support for this statement provided in chapter 5. Hovakimian (2006) in his recent study questions Baker and Wurgler's (2002) conclusion and finds evidence that the effect of past market-to-book ratio reflects growth opportunities rather than market timing.

Hovakimian (2006) develops new evidence that suggests re-evaluation of the Baker and Wurgler's (2002) conclusion about capital structure policy. Contrary to Baker and Wurgler (2002), Hovakimian (2006) find that the past market-to-book ratios do not have long lasting effects on capital structure. Rather, his results are consistent with the hypothesis that past market-to-book ratio contains information about growth opportunities that can not be captured by current capital structure.

In chapter 5 the study followed Baker and Wurgler (2002) and replicate their work which suggests that Australian firms are influenced by market-timing and that past market-to-book has a statistically significant effect on leverage. However, the results show that the effect of past market-to-book ratio is sensitive to the data set

used in analysis. In this chapter, Hovakimian's (2006) argument is evaluated using the same sample for the period of 1997 to 2005, to see whether the relationship between past/historical market-to-book ratio reflects growth opportunities rather than market timing as proposed by Hovakimian (2006).

Following Hovakimian (2006), it is found that there is significant negative effect of past weighted average market-to-book on leverage even after controlling for the cumulative effect of past net debt and net equity issues. This is not consistent with the market timing hypothesis because this hypothesis says there should be no effect of past market-to-book if one controls for cumulative net debt and net equity issues in the past. But if it contains information about growth opportunities then the effect of past market-to-book on leverage should remain significant regardless of past financing activity. Furthermore, analysis also shows that the negative affect on leverage and changes in leverage can be obtained using a weighted average market-to-book ratio based on future rather than past market-to-book. This result is consistent with the hypothesis that both historical and future average market-to-book ratio reflect the long-term growth opportunities for a firm. Overall, results are similar to the findings of Hovakimian (2006) and this suggests that equity market timing is an unlikely explanation for the results noted in chapter 5.

The current research extends the analysis in chapter 5 in a number of ways. First, the hypothesis that past weighted average market-to-book ratio (EFWAMB) is related to leverage because it contains information for growth opportunities is examined and find evidence to support this hypothesis. Another contribution of this study is the evidence that the negative effect on leverage and changes in leverage can be explained by future weighted average market-to-book (FEFWAMB). These results are consistent with the hypothesis that both past and future weighted average market-to-book are related to leverage as they reflect growth opportunities but are not consistent with equity market timing. However, the analyses in this chapter also show that the results are sensitive to data filter choice.

6.2 DATA AND SUMMARY STATISTICS

The sample consists of all listed and delisted companies from Fin Analysis and Dat Analysis for the period of 1997-2005 provided by Aspect Huntley. Like the previous chapter the study uses the full data set and two different filtered data sets for our analysis. The full data set is referred as the unfiltered data and it consists of 1438 companies. The first of the filtered data sets follows the Baker and Wurgler (2002) filtered data that is similar to Hovakimian (2006). Following this approach, the study drops firm year observations where leverage is above 1, minimum book value of assets below $10 million, when the market-to-book ratio is above 10 and also excludes firm year observations when external finance weighted average market-to-book (EFWAMB) is above 10. The sample of firms is reduced to 981 using this filter choice for data analysis. The second filter is a four standard deviation filter designed to reduce the effect of outliers. After using this filter the sample of firms is reduced from 1438 to 1146.

Hovakimian (2006) choose to analyse the capital structure choice of US firms using firm years from the period of 1983 to 2002. In this analysis of Australian firms, all firms available over the period from 1997 to 2005 are selected. Following Hovakimian (2006) book leverage is defined as the long-term debt plus short-term debt over total assets and net debt issues as the change in long-term debt plus short-term debt. Summary statistics with all filters for market-to-book ratio, firm size, EFWAMB and other firm characteristics that are important for this analysis are reported in Table 6.1.

Summary statistics of Table 6.1 are similar to those of Hovakimian (2006) especially for the Baker and Wurgler (2002) filtered data results.

Table 6.1: Summary Statistics of variables used in chapter 6

Sample covers the period, 1997 to 2005. Leverage is defined as the (Long-term (LT) debt + Short-term (ST) debt over total assets). The EFWAMB is the external finance weighted average market-to-book ratio. The market-to-book ratio is defined as the (Total assets - book value of equity + market value of equity)/total assets. Market value of equity is (price × shares outstanding) and Book value of equity is (Total assets – total liabilities). Tangibility is measured as the net property, plant and equipment/total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue.

	Baker and Wurgler filtered data, N=3595			
	Mean	SD	Min	Max
Book leverage, $\left(\frac{LT+ST}{A}\right)$	0.19	0.18	0.00	2.73
EFWAMB	0.94	1.23	0.00	9.93
M/B Ratio	1.55	1.10	0.09	9.59
Fixedassetangibility, $\left(PPE/A\right)_t$	0.32	0.63	0.00	30.24
Profitability, $\left(EBITDA/A\right)_t$	0.08	0.17	-2.16	1.14
Firm Size, $Log(S)_{t-1}$	7.73	1.22	1.32	10.66
	Unfiltered data, N=4939			
Book leverage, $\left(\frac{LT+ST}{A}\right)$	0.40	10.32	0.00	563.1
EFWAMB	1.10	2.72	0.00	148.74
M/B Ratio	2.51	19.84	0.00	881.5
Fixedassetangibility, $\left(PPE/A\right)_t$	0.34	2.23	0.00	107.7
Profitability, $\left(EBITDA/A\right)_t$	-0.36	14.34	-796	140.0
Firm Size, $Log(S)_{t-1}$	7.12	1.50	1.00	10.7
	Four Standard Deviation filtered data, N=4681			
Book leverage, $\left(\frac{LT+ST}{A}\right)$	0.19	0.38	0.00	9.87
EFWAMB	1.06	1.45	0.00	12.07
M/B Ratio	2.03	2.87	0.00	72.58
Fixedassetangibility, $\left(PPE/A\right)_t$	0.26	0.32	0.00	6.87
Profitability, $\left(EBITDA/A\right)_t$	-0.09	0.93	-28.82	34.00
Firm Size, $Log(S)_{t-1}$	7.11	1.52	1.32	10.66

6.3 CAPITAL STRUCTURE AND PAST MARKET VALUATIONS

6.3.1 Leverage regressions and variable definitions

Initially, following Baker and Wurgler (2002) and Hovakimian (2006) leverage is analysed using external finance weighted average market-to-book (EFWMB). Table 6.2 presents results using pooled ordinary least squares estimates (OLS) and fixed effect specification.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t \quad (6.1)$$

Equation 6.1 is similar to equation 3.6, discussed in the chapter 3, except leverage and net debt issued (used to calculate EFWAMB) is defined in a different way in this study. In (6.1) leverage is the dependent variable and it is defined as long-term debt plus short-term debt over total assets for the period t. The control variables are the firm characteristics used in previous research (Baker & Wurgler 2002; Fama & French 2002; Frank & Goyal 2003; Hovakimian 2006; Rajan & Zingales 1995) and include firm size that is defined as the natural logarithm of total revenue ($Log\ (S)_{t-1}$), asset tangibility defined as the net property, plant and equipment over total assets (PPE / A_{t-1}), profitability is measured as earnings before interest, tax, depreciation and amortization over total assets $(EBITDA / A)_{t-1}$ and market-to-book is defined as total assets minus book value of equity plus market value of equity over total assets[25] $(M / B)_{t-1}$. And, the final variable is the external finance weighted average market-to-book $(EFWAMB)^*$ that is introduced in Baker and Wurgler (2002). This was introduced in chapter 5 as a proxy for past market timing. However, here it is denoted with a star sign to show a difference in the calculation of EFWAMB compared with Baker and Wurgler (2002).

[25] Here, market value of equity is price times the shares outstanding and book value of equity is total assets minus total liabilities minus preferred stock plus deferred taxes. Due to unavailability of information the study does not consider preferred stock or deferred taxes while computing book value of equity.

$$EFWAMB^{*}_{t} = \sum_{s=0}^{t-1} \frac{e_s + d_s}{\sum_{r=0}^{t-1} e_r + d_r} \times \left(\frac{M}{B} \right)_s \qquad (6.2)$$

The parameter, e and d, denote net equity and net debt issues respectively. Here, net equity issued is defined as the change in book equity minus the change in retained earnings and net debt issued is defined as the change in debt (change in long-term + short-term debt). The definition of net debt issues in this equation is different than in Baker and Wurgler's (2002) net debt issues definition. Similar to Baker and Wurgler (2002) the minimum weight of market-to-book ratio is set to zero to avoid the negative weights problem.

EFWAMB* is the weighted average of a time series of past market-to-book ratio that started with a first observation available in the sample and ended with the market-to-book ratio at (t-1). The weight is defined as the ratio of external financing divided by the total external financing raised by the firm in year (t = 0) through (t-1). Thus, when firms issue equity when their market-to-book ratios are high EFWAMB* will also be high.

Regression (6.1) replicates that of Baker and Wurgler (2002), Hovakimian (2006) and the chapter 5 leverage regression.[26] However, the definition of leverage, and net debt issued is changed for this study following Hovakimian (2006). Here, leverage has been defined as long-term debt plus short-term debt over total assets and net debt issued is defined as the change in long-term debt plus short-term debt. Baker and Wurgler (2002) defined leverage in two ways: Book leverage that is book debt to total assets and Market leverage that is book debt divided by the total assets minus book equity plus market equity. Further, net debt issued is defined as the residual change in assets[27]. Table 6.2 report the results of this analysis.

[26] See Table III, Panel A, full firm's row of Baker and Wurgler (2002), Table 1 of Hovakimian (2006) and Table 5.6 of chapter 5 respectively.
[27] See the definitions in Baker and Wurgler (2002), page 5.

Table 6.2: Determinants of book leverage (For the period, 1997-2005): All Filters

Both pooled ordinary least squares and fixed effects panel analysis of book leverage on the market-to-book ratio, fixed assets, profitability and firm size using all filters for the period of 1997 to 2005.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)_t^{*} + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. N is defined as the number of observations used in the analysis. Dependent variable book leverage is defined as, long-term debt + short-term debt over total assets. The EFWAMB* is external finance weighted average market-to-book ratio. The market-to-book ratio is defined as, total assets - book value of equity + market value of equity over total assets. Tangibility is measured as, the net property, plant and equipment over total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue. Robust t-statistics are in parenthesis.

		$(EFWAMB)_t^{*}$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
				Panel A: Baker and Wurgler filtered data								
Pooled OLS	3595	-0.007	(-5.20)	-0.013	(-3.73)	0.045	(3.10)	-0.038	(-1.45)	0.045	(17.0)	0.13
Fixed effects	3595	-0.002	(-1.05)	-0.009	(-3.16)	0.045	(3.95)	-0.048	(-1.64)	0.045	(12.3)	0.34
				Panel B: Unfiltered data								
Pooled OLS	4939	-0.082	(-1.06)	-0.056	(-0.95)	0.005	(0.75)	-0.443	(-2.07)	-0.003	(-0.03)	0.39
Fixed effects	4939	-0.080	(-1.12)	-0.054	(-0.98)	0.007	(0.85)	-0.423	(-2.20)	-0.067	(-0.59)	0.50
				Panel C: Four Standard Deviation filtered data								
Pooled OLS	4681	0.009	(1.79)	-0.004	(-2.79)	0.125	(10.9)	-0.016	(-0.64)	0.036	(8.65)	0.05
Fixed effects	4681	0.014	(2.22)	-0.006	(-2.97)	0.122	(7.99)	-0.016	(-0.70)	0.037	(6.92)	0.21

Baker and Wurgler (2002) contend that there is a negative relationship between EFWAMB* and leverage. Essentially a relatively high market-to-book ratio leads to equity issues and thus induces a negative relationship between market-to-book ratio and leverage (Hovakimian 2006). Table 6.2 Panel A with Baker and Wurgler (2002) filtered data, it is found that both EFWAMB* and $(M/B)_{t-1}$ is significantly negatively related with leverage with the exception in the fixed effect model result for EFWAMB*. This result is similar to those of Baker and Wurgler (2002), Hovakimian (2006) and the previous chapter analysis. Further, unfiltered data results, reported in Table 6.2 Panel B, show that the effect of EFWAMB* and $(M/B)_{t-1}$ are not statistically significant for leverage and this is similar to the findings for the unfiltered data reported in chapter 5 especially for book leverage. The analysis for the four standard deviation filtered data set, reported in Table 6.2, Panel C shows that the market-to-book ($(M/B)_{t-1}$) is significantly negatively related with leverage and EFWAMB* is significantly positively related to leverage. This is consistent with the findings of chapter 5 (though significant level vary) but inconsistent with the findings of Baker and Wurgler (2002) and Hovakimian (2006) who show a significant negative relationship between leverage and EFWAMB*.

6.3.2 Discussion of the results

Both Baker and Wurgler (2002) and Hovakimian (2006) observe a significant negative relationship between external finance market-to-book and leverage. Our results also show a significant negative relationship between EFWAMB* and leverage using the Baker and Wurgler (2002) filtered data results. However, the results are sensitive to the filter choice used in the analysis. When the study use the four standard deviation filtered data set, it is shown that EFWAMB* has significant positive effect on leverage and this is not consistent with the market-timing hypothesis. Thus, even when market valuation is high a firm may not increase its equity issues. Thus the results imply that past attempts at market timing may be short lived and need not always lead to debt reduction. In summary, while there are some results that support the Baker and Wurgler (2002) timing hypothesis, the market timing result is not robust to the data filter choice.

6.4 IS THE EFWAMB* RELATED TO GROWTH OPPORTUNITY

In this section, the hypothesis that the external finance weighted average market-to-book (EFWAMB*) or past market timing is related to the current leverage $\left(\frac{LT+ST}{A}\right)_t$ is tested. This provides an alternative to the current market-to-book ratio, as a proxy for growth opportunities.

6.4.1 Market-timing and leverage

According to the market-timing hypothesis, firms do not have a target debt ratio. Therefore, the relationship between market-to-book and observed leverage is driven by increases in net equity issued when the market-to-book ratio of a firms is high. This ultimately leads to leverage reduction. If other things hold equal, increases in net equity issues and decreases in net debt issues should result in lower leverage. Thus a negative relation between market-to-book and leverage is expected (Hovakimian, A 2006). Hence, Hovakimian (2006) argued that EFWAMB* should not have any effect on leverage if the value of net equity and net debt issues are controlled for. Baker and Wurgler (2002) implied that "temporary fluctuations in the market-to-book ratio and other control variables should have temporary effects" (p. 3). Hovakimian (2006) argues that if this fluctuation is temporary then market-to-book should have no effect on target debt ratio as manager should view this fluctuation as noise. He proposes an alternative hypothesis arguing that the observed debt ratio will be related to EFWAMB* even after controlling for the value of net equity and net debt issues if it reflects growth opportunity. He argues that firms with high growth opportunities are reluctant to take on higher debt ratios and so he proposes a test of whether EFWAMB* is a measure of growth opportunities with the inclusion of two additional variables in the base regression model (3.6) (EqIs and DbIs).

In the equation (3.7) EqIs and DbIs refer to the cumulative net equity issued and the cumulative net debt issued respectively over the period from 1997-2005. The same period is used to compute EFWAMB*. Definitions for EqIs and DbIs are discussed in chapter 3.

In Table 6.3, Panel A, the Baker and Wurgler (2002) filtered data results show that the effect of net debt issued on leverage (0.170) is statistically much stronger than the effect of net equity issued (-0.011) on leverage. The pooled regression results also show that the effect of EFWAMB* remains significantly negative after controlling for cumulative net debt and net equity issued. This result is consistent with the findings of Hovakimian (2006)[28] but not consistent with the market timing hypothesis. The effect of EFWAMB* remains significantly negative and this suggests factors other than timing such as growth opportunities are most likely to explain the results (Hovakimian 2006).

With this extended model there is support for market timing with the unfiltered data. The unfiltered results reported in Table 6.3, Panel B, show that the effect of net equity issued is much stronger than the effect of net debt issued and it also shows that EFWAMB* is negatively related to leverage, though the effect of EFWAMB* on leverage is statistically insignificant, consistent with the previous results (Table 6.2, Panel B). As indicated in previous analysis these results are sensitive to the effect of outliers but they are broadly supportive of market timing.

Regression (3.7) is also estimated using the four standard deviation filtered data (reported in Table 6.3, Panel C). The results of pooled OLS estimates show that the effect of net equity issued has a statistically significant impact on leverage with significant positive effect of EFWAMB*. But the fixed effect model exhibits significant positive effect of EFWAMB* and insignificant effect of both cumulative net debt and net equity issues. Overall, Table 6.3, Panel C result implies that after controlling for past net equity and past net debt issued, EFWAMB* has significant positive effect on leverage (similar to the Table 6.2, Panel C result). This is not consistent with the findings of Hovakimian (2006). Because, he argues that, if the EFWAMB is a measure of growth opportunities then even after controlling for the value of net equity and net debt, it should be significantly negatively related to leverage.

[28] See Hovakimian (2006) Table 6, page 234.

Table 6.3: Determinants of book leverage with EqIs and DbIs (For the period, 1997-2005): All Filters

Both pooled ordinary least squares and fixed effects panel analysis of leverage on the market-to-book ratio, fixed assets, profitability, firm size, cumulative net debt and cumulative net equity issued using all filters for the period of 1997 to 2005.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1} + u_t$$

The intercept, a, is not reported. N is defined as the number of observations used in the analysis. Dependent variable leverage is defined as, long-term debt + short-term debt over total assets. The EFWAMB* is external finance weighted average market-to-book ratio. The market-to-book ratio is defined as, total assets - book value of equity + market value of equity over total assets. Tangibility is measured as, the net property, plant and equipment over total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue. Cumulative net equity issued (EqIs) is the net equity issued divided by total assets cumulated over all years preceding the current year and cumulative net debt issued (DbIs) is the net debt issued divided by total assets cumulated over all years preceding the current year (net debt issued is measured as the change in long term plus short term debt). Robust t-statistics are in parenthesis.

		$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		*EqIs*		*DbIs*		
Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
							Panel A: Baker and Wurgler filtered data								
Pooled OLS	3595	-0.006	(-3.50)	-0.013	(-4.19)	0.039	(2.91)	-0.041	(-1.73)	0.042	(17.00)	-0.011	(-1.78)	0.170	(4.14)	0.20
Fixed effects	3595	0.000	(0.06)	-0.012	(-4.38)	0.039	(3.66)	-0.045	(-1.90)	0.042	(13.91)	-0.006	(-0.96)	0.179	(4.75)	0.41
							Panel B: Unfiltered data								
Pooled OLS	4939	-0.023	(-1.33)	-0.003	(-0.31)	0.000	(-0.02)	-0.671	(-16.31)	0.053	(0.59)	0.162	(20.23)	0.188	(1.23)	0.57
Fixed effects	4939	-0.026	(-1.41)	-0.003	(-0.25)	0.000	(0.09)	-0.668	(-16.93)	0.015	(0.13)	0.161	(20.13)	0.215	(1.38)	0.66
							Panel C: Four Standard Deviation filtered data								
Pooled OLS	4681	0.009	(1.79)	-0.004	(-2.79)	0.125	(10.9)	-0.016	(-0.64)	0.036	(8.65)	0.000	(5.21)	-0.001	(-0.38)	0.05
Fixed effects	4681	0.014	(2.22)	-0.006	(-2.96)	0.122	(8.01)	-0.016	(-0.70)	0.037	(6.92)	0.000	(0.67)	-0.002	(-0.52)	0.21

Hence, this result casts some doubt over the Hovakimian (2006) explanation. It is possible that the past market-to-book is not a good proxy for growth opportunities for Australian firms. And suggest that the effect of past market timing will not always lead to equity issues or debt reduction for Australian firms.

6.4.2 Determinants of changes in leverage

It is argued that if past market-to-book ratio is a proxy for past market timing then it will have no effect on changes in current leverage while the study controls for the market-to-book ratio and other relevant factors. On the other hand, if the past market-to-book ratio is associated with growth opportunities it will have significant impact on current capital financing decisions.

In this section the change in leverage is regressed on the independent variables that are also used in regression (6.1). Baker and Wurgler's (2002) change in leverage regression (3.3) is similar to the regression in 6.3 except that EFWAMB* was not included in their regression[29]. In addition, the model also includes lagged leverage as an independent variable to be consistent with previous research (Baker & Wurgler 2002; Hovakimian 2006).

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t \qquad (6.3)$$

Here, the dependent variable, changes in leverage, is defined as leverage at time (t) minus leverage at time (t-1). Other control variables are similar to those that are used in previous regressions and discussed in chapter 3. Results from analysis of changes in leverage for all filters are reported in Table 6.4.

The results in Table 6.4 Panel A show that changes in leverage are positively related to asset tangibility, firm size and negatively related to market-to-book ratio, EFWAMB* and lagged leverage using Baker and Wurgler (2002) filtered data. This

[29] See Baker and Wurgler's (2002), Table II, Panel A

result is similar to those of Hovakimian (2006) though the statistically significant negative coefficient on EFWAMB* is not consistent with the Baker and Wurgler's (2002) timing hypothesis. The Table 6.4 Panel A results suggest the existence of a direct EFWAMB* effect on current capital structure that can not be explained by the persistence of market-to-book ratio. Hence it is consistent with the hypothesis that the EFWAMB* is negatively related to the observed leverage because it proxies for growth opportunities.

Unfiltered results reported in Table 6.4, Panel B are similar to the Baker and Wurgler (2002) filtered data results and those of Hovakimian (2006), and so are not discussed separately though the parameter signs vary somewhat for the control variables. The results in Panel C (Table 6.4) show that changes in leverage are positively related to asset tangibility, firm size and EFWAMB* but negatively related to market-to-book ratios and lagged leverage using four standard deviation filtered data. There is an insignificant positive effect of EFWAMB* on leverage for the four standard deviation filtered data which is inconsistent with both the Baker and Wurgler (2002) filtered data results and with Hovakimian's (2006) hypothesis. Table 6.4, Panel C shows that the results are sensitive to the filter choice used in data set selection.

Table 6.4: Determinants of changes in book leverage (For the period, 1997-2005): All Filters

Both pooled ordinary least squares and fixed effects panel analysis of leverage on the market-to-book ratio, fixed assets, profitability, firm size, cumulative net debt and cumulative net equity issued using all filters for the period of 1997 to 2005.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is defined as the number of observations used in the analysis. Dependent variable change in leverage is defined as, (t) minus leverage (t-1). The EFWAMB* is external finance weighted average market-to-book ratio. The market-to-book ratio is defined as, total assets - book value of equity + market value of equity over total assets. Tangibility is measured as, the net property, plant and equipment over total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue. Last variable is the lagged leverage. Robust t-statistics are in parenthesis.

		$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*E*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
						Panel A: Baker and Wurgler filtered data								
Pooled OLS	3595	-0.005	(-7.36)	-0.001	(-0.37)	0.014	(3.36)	-0.015	(-1.23)	0.011	(5.37)	-0.281	(-8.20)	0.13
Fixed effects	3595	-0.003	(-2.14)	0.000	(0.004)	0.015	(3.34)	-0.022	(-1.38)	0.013	(4.84)	-0.285	(-8.23)	0.34
						Panel B: Unfiltered data								
Pooled OLS	4939	-0.440	(-5.05)	0.011	(0.27)	-0.021	(-2.50)	-0.244	(-1.89)	-0.149	(-1.53)	0.113	(0.39)	0.52
Fixed effects	4939	-0.474	(-6.38)	0.021	(0.57)	-0.016	(-1.74)	-0.224	(-1.93)	-0.118	(-1.15)	0.165	(0.65)	0.62
						Panel C: Four Standard Deviation filtered data								
Pooled OLS	4681	0.002	(0.46)	-0.005	(-2.58)	0.038	(0.93)	0.012	(0.46)	0.019	(4.29)	-0.547	(-4.21)	0.26
Fixed effects	4681	0.004	(1.07)	-0.006	(-3.09)	0.035	(0.79)	0.011	(0.53)	0.021	(4.50)	-0.551	(-4.58)	0.39

6.4.3 Future market-to-book/market timing and leverage

In this section, following Hovakimian (2006), the leverage regression (6.1) as well as the change in leverage regression (6.6) are re-estimated using future external finance weighted average market-to-book (FEFWAMB) as a proxy for future market timing and external finance rather than past market timing. FEFWAMB is defined in chapter 3 (See equation 3.10)

Hovakimian (2006) argues that if firm growth opportunities change slowly, then both EFWAMB* and FEFWAMB will be the proxies for long-term growth opportunities and that is why he substitutes FEFWAMB for the EFWAMB*. This implies that the effects of both of these variables on capital structure should be similar. Yet, if EFWAMB* is a proxy for past market timing then FEFWAMB should be a proxy for future market timing and therefore, it should have no effect on current leverage. In contrast, if it is associated with the growth opportunities then it will have a significant impact on current leverage. The results of the regressions (3.11 and 3.12) are reported in Tables 6.5 and 6.6.

The Baker and Wurgler (2002) filtered data results in Table 6.5 Panel A (using 3.11), are consistent with Hovakimian (2006) and the hypothesis that the weighted average market-to-book ratio is a proxy for growth opportunities because FEFWAMB exhibits a significant negative impact on leverage. Like previous regressions the study controls for recent market-to-book ratio and so it is argued that the effect of both EFWAMB* and FEFWAMB can not be ascribed to the correlation between these time series averages and current market-to-book ratio.

Further, unfiltered results and four standard deviation filtered results reported in Table 6.5 Panel B and C show the similar results to the Baker and Wurgler (2002) filtered data results and the results reported by Hovakimian (2006). One exception is the pooled OLS estimated coefficient for FEFWAMB which is not significant using the unfiltered data. Overall, based on the Table 6.5 results the study concludes that the significant impact of future market-to-book ratio on capital structure reflects the importance of growth opportunities, rather than equity market timing in determining leverage.

Table 6.5: Future EFWAMB and capital structure (For the period, 1997-2005): All Filters

Both pooled ordinary least squares and fixed effects panel analysis of leverage on the market-to-book ratio, fixed assets, profitability, firm size, cumulative net debt and cumulative net equity issued using all filters for the period of 1997 to 2005.

$$\left(\frac{LT+ST}{A}\right)_t = a + b\left(FEFWAMB\right)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog\left(S\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is defined as the number of observations used in the analysis. Dependent variable leverage is defined as the long-term debt plus short-term debt over total assets. The FEFWAMB is external finance weighted average of future market-to-book ratio. The market-to-book ratio is defined as, total assets - book value of equity + market value of equity over total assets. Tangibility is measured as, the net property, plant and equipment over total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue. Robust t-statistics are in parenthesis.

		$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
					Panel A: Baker and Wurgler filtered data							
Pooled OLS	3595	-0.006	(-2.07)	-0.014	(-3.45)	0.041	(3.28)	0.023	(-0.66)	0.042	(13.71)	0.12
Fixed effects	3595	-0.008	(-2.29)	-0.008	(-2.23)	0.041	(4.09)	-0.035	(-1.01)	0.044	(10.64)	0.33
					Panel B: Unfiltered data							
Pooled OLS	4939	-0.001	(-1.50)	-0.003	(-0.17)	0.000	(-0.08)	-0.674	(-15.23)	0.012	(0.11)	0.57
Fixed effects	4939	-0.002	(-2.99)	-0.002	(-0.15)	0.001	(0.12)	-0.671	(-15.93)	-0.030	(-0.22)	0.66
					Panel C: Four Standard Deviation filtered data							
Pooled OLS	4681	-0.006	(-4.17)	0.002	(0.50)	0.112	(9.02)	-0.023	(-0.72)	0.037	(7.88)	0.04
Fixed effects	4681	-0.007	(-4.97)	0.002	(0.59)	0.112	(7.04)	-0.024	(-0.80)	0.040	(6.47)	0.20

In this section, the changes in leverage regression (3.12) is estimated using the same independent variables to see whether FEFWAMB has any effect on changes in leverage and the results are reported in Table 6.6 using each of the three filters.

The results in Table 6.6, for each of the three filters, are similar to those of Table 6.5. There is a statistically significant FEFWAMB effect on firm capital structure is noted. Overall the result suggests that the impact of future external weighted average market-to-book is unlikely to be due to equity market timing and this is consistent with the Hovakimian (2006) hypothesis.

6.4.4 Discussion

Hovakimian (2006) and Baker and Wurgler (2002), show that past market-to-book has a significant impact on current leverage and current changes in leverage. Hovakimian (2006) also shows that when the weighted average future market-to-book ratio replaces the weighted average of past market-to-book ratio the relationship between the weighted average market-to-book and current capital structure remains.

The Baker and Wurgler (2002) filtered data results reported in Table 6.3 Panel A are consistent with the Hovakimian (2006) hypothesis, with a negative effect of EFWAMB* after control for cumulative net equity and net debt issues. This result supports the hypothesis that EFWAMB* contains information about growth opportunities. And it also suggests that firms with higher value of EFWAMB* choose to issue equity. Thus, leverage is reduced to ensure that the firm can take advantage of market timing opportunities in the future. Unfiltered data results (Panel B, Table 6.3) shows statistically insignificant EFWAMB* coefficients which suggests that results are broadly supportive of market timing. However, a four standard deviation filtered data sets from Panel C of Table 6.3 shows significant positive EFWAMB* effect on leverage after control for cumulative net equity and net debt issues. This result casts some doubt on Hovakimian (2006) and Baker and Wurgler (2002) and suggests that past market timing has not always led to equity issues or debt reductions for Australian firms.

Furthermore, Table 6.4 Panel A and Panel B (using Baker and Wurgler (2002) filtered data and unfiltered data) show a statistically significant effect for EFWAMB*.

It is argued that higher values of EFWAMB* that is when market-to-book is high firms are able to raise external finance. Thus, for a given value of current market-to-book, the higher the value of EFWAMB*, the less likely a firm will issue equity. Yet, firms with high past EFWAMB* have a higher incidence of issuing equity than firms with lower EFWAMB* (Hovakimian 2006). The four standard deviation filtered data from Panel C of Table 6.4 shows an insignificant positive effect for EFWAMB*. This is consistent with past market timing not being persistent.

Finally, if the FEFWAMB reflects future market timing opportunities then firms with higher FEFWAMB should be reluctant to issue equity now. That is, FEFWAMB should have positive impact on leverage and changes in leverage in Tables 6.5 and 6.6 rather than a negative impact if market timing applies. The study observes a negative effect for FEFWMB with respect to leverage. Given that future weighted average market-to-book contains information for growth opportunities, then this result rejects the market timing argument.

Overall, the results are consistent with the hypothesis that EFWAMB* contains information about growth opportunities that can not be captured by current market-to-book ratio and that the relationship observed between this variable and leverage leads to rejection of the Baker and Wurgler's (2002) market timing hypothesis.

Table 6.6: Future EFWAMB and changes in book leverage (For the period, 1997-2005): All Filters

Both pooled ordinary least squares and fixed effects panel analysis of leverage on the market-to-book ratio, fixed assets, profitability, firm size, cumulative net debt and cumulative net equity issued using all filters for the period of 1997 to 2005.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is defined as the number of observations used in the analysis. Dependent variable change in leverage is leverage (t) minus leverage (t-1). The FEFWAMB is external finance weighted average of future market-to-book ratio. The market-to-book ratio is defined as, total assets - book value of equity + market value of equity over total assets. Tangibility is measured as, the net property, plant and equipment over total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And Size is the natural logarithm of total revenue. Last variable is the lagged leverage. Robust t-statistics are in parenthesis.

		$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*N*	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*E*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data														
Pooled OLS	3595	-0.002	(-2.10)	-0.001	(-0.74)	0.009	(2.12)	-0.010	(-0.68	0.004	(3.94)	-0.181	(-7.16)	0.06
Fixed effects	3595	-0.003	(-2.55)	0.001	(0.21)	0.010	(2.03)	-0.017	(-0.99)	0.006	(2.90)	-0.185	(-6.46)	0.27
Panel B: Unfiltered data														
Pooled OLS	4939	-0.001	(-1.29)	-0.006	(-0.95)	-0.008	(-1.22)	0.050	(0.88)	-0.139	(-1.19)	0.327	(3.12)	0.05
Fixed effects	4939	-0.002	(-1.92)	-0.006	(-1.05)	-0.005	(-1.14)	0.057	(1.00)	-0.170	(-1.20)	0.339	(3.32)	0.24
Panel C: Four Standard Deviation filtered data														
Pooled OLS	4681	-0.002	(-3.58)	-0.004	(-2.54)	0.013	(0.25)	-0.007	(-0.25)	0.018	(3.30)	-0.465	(-3.42)	0.18
Fixed effects	4681	-0.002	(-1.00)	-0.005	(-3.07)	0.009	(0.17)	-0.008	(-0.31)	0.020	(3.18)	-0.466	(-3.56)	0.31

6.5 CONCLUSION

Following Modigliani and Miller's (1958) theory, a large number of literature have been developed to explain the capital structure policy by introducing frictions omitted in the original Modigliani and Miller framework (Chrinko & Singha 2000). Modigliani and Miller (1958) have created a much richer model of the firm but capital structure choice remains unexplained.

Following Baker and Wurgler (2002) (chapter 5), market timing is introduced to explain observed corporate capital structure. The study documents that market timing seems to have explanatory power over the capital structure choice of Australian firms. In addition, it is found that the effect of past market-to-book ratio is not the single most important variable explaining cross sectional variation in leverage. Baker and Wurgler (2002) contend that the observed capital structure is the cumulative outcome of past attempts to time the equity market timing. Hovakimian (2006) questions Baker and Wurgler (2002) conclusion and provides evidence that the long lasting effect of the market-to-book ratio does not reflect past equity market timing (EFWAMB*), rather it contains information about growth opportunities.

In this chapter the study evaluates the Hovakimian (2006) argument u sing the same sample as used in chapter 5 to see whether past equity market timing reflects growth opportunities. It is found that the effect of EFWAMB* is significant with respect to current leverage and changes in leverage. Results also support the hypothesis that EFWAMB* is related to the observed capital structure because it contains information about future growth opportunities. Furthermore, when weighted average future market-to-book ratio replaces the weighted average past market-to-book ratio, it is found that current leverage is also related to future weighted average market-to-book. This is not consistent with market timing but it is consistent with past market-to-book ratios reflecting growth opportunities. However, the result is somewhat sensitive to data filter choice.

To summarize, results are similar to those of Hovakimian (2006). This suggests that the capital structure choice is unlikely to be due solely to equity market timing but it would appear growth opportunities provide a reasonable explanation for the current market-to-book ratio effect noted by Baker and Wurgler (2002).

CHAPTER 7

BROAD INDUSTRY EFFECTS

7.1 INTRODUCTION

The previous chapter analyses the impact of market timing behavior and growth opportunities on Australian firm capital structure using all available companies for the period from 1997-2005. Similar analyses are conducted in this chapter comparing mining and non-mining firms. Australia is recognized as one of the important exporters of mining resources around the globe (Fiscore 2007) and while the mining sector is one of the biggest sectors in Australia (How 2000), research into the mining sector has received limited attention. Exceptions include the IPO literature (How 2000; Lee, Taylor & Walter 1996)

This study re-estimates the original regression model of Baker and Wurgler (2002) and Hovakimian (2006) applying dummy variables (Dummy) to test for significant differences in mining verses non-mining firm coefficient estimates. There are significant differences between mining and non-mining firms are observed. However, the results are sensitive to data filter choice. Significant differences between mining and non-mining firms are consistent with the prior studies in the other areas of research (Balachandran & Tanner October, 2001; Clements & Johnson 2000; How 2000; Lee, Taylor & Walter 1996). Literature review, methodology and data used in this chapter are discussed in chapters 2, 3 & 4 respectively and so are not reported here.

7.2 MARKET TIMING AND CAPITAL STRUCTURE

Dummy variables are applied in the original Baker and Wurgler (2002) equation to test for statistically significant differences between mining and non-mining firm coefficients and for broad industry effects (mining vs. non-mining firms) on capital structure choice. The model used for testing is as follows:

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1}$$
$$+ g\left(\frac{M}{B}\right)_{t-1} * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + j\log(S)_{t-1} * Dummy + k\left(\frac{D}{A}\right)_{t-1} * Dummy + u_t$$

(7.1)

Here, in equation (7.1) which is similar to (3.13), the dummy is set to 1 for non-mining firms and set to 0 for mining firms. The first line provides estimates of the coefficients that apply to the mining firms and the second line of coefficients refers to the difference in the coefficients (the coefficient for the non-mining firms less the coefficient for the mining firms). The other control variables are defined in chapter 3.

7.2.1 Baker and Wurgler (2002) filtered data

Results of analysis using equation 7.1 are reported in Table 7.1. Pooled OLS results in Table 7.1, Panel A, show that there is significant difference between mining and non-mining firm for market-to-book effect at 10% level though the effect is not evident for mining firms. On the other hand, fixed effect analysis does not support the existence of this difference. The coefficients for the remaining control variables provide no evidence of significant differences which suggest that there is no broad industry impact when Baker and Wurgler (2002) sample selection rules are applied to the analysis.

Decomposition results for the Baker and Wurgler (2002) filtered data are reported in Table 7.1 (Panels B, C and D). Panel B of Table 7.1 illustrates that both pooled OLS and the fixed effect panel data analysis show a significant difference for mining and non-mining firms in case of the market-to-book coefficient at the 10% level with non-mining firms equity issues being less sensitive to market-to-book than mining firms.

Panel C of Table 7.1 shows a significant difference between mining firms and non-mining firms with respect to the relationship between leverage and firm size at the 10% level. But there is no significant effect noted for market-to-book. Finally, from Panel D, no significant difference is noted between mining and non-mining firms. Overall, the analysis of Baker and Wurgler (2002) filtered data results of Table 7.1 provide little evidence of differences between mining and non-mining firms.

Table 7.1: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (For the period, 1997-2005)

Analysis on annual change in book leverage and its components with respect to market-to-book ratio, fixed assets, profitability, firm size and lagged leverage including dummy variable using Baker and Wurgler (2002) filtered data for mining and non-mining firms. Both pooled ordinary least squares (OLS) and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1}$$

$$+ g\left(\frac{M}{B}\right)_{t-1} * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + j\log(S)_{t-1} * Dummy + k\left(\frac{D}{A}\right)_{t-1} * Dummy + u_t$$

The intercept, a, is not reported. Total 3595 number of observations used in the analysis. Here, dummy is set to 1 for non-mining firms and set to 0 for mining firms. Book value of leverage is defined as book debt to assets $\left(\frac{D}{A}\right)_t$. The market-to-book ratio $\left(\frac{M}{B}\right)$ is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility $\left(\frac{PPE}{A}\right)$ is defined as net property, plant and equipment divided by assets. Profitability $\left(\frac{EBITDA}{A}\right)$ is defined as operating income before interest, taxes, depreciation and amortization divided by total assets. Firm size is defined as the log of total revenue, ($Log(S)_{t-1}$). Panel A reports the annual change in leverage. Effect of net equity issues is reported in panel B where net equity issues, $\left(\frac{e_t}{A_t}\right)$ is defined as the change in book equity minus the change in retained earnings divided by assets. The newly retained earnings component is reported in Panel C and it is $\left(\frac{\Delta RE_t}{A_t}\right)$ defined as the change in retained earnings divided by assets. Finally, panel D reports the components of residual change in leverage $E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)$. The coefficients from the regression are reported on two separate lines. The first line refers to the coefficients estimated for each variable and the second line refers to the coefficients estimated for the product of the dummy and each variable. While the first line provides estimates of the coefficients that apply to the mining firms, the second line of coefficients refers to the difference in the coefficients (the coefficient for the non-mining firms less the coefficient for the mining firms). Robust t-statistics are in parenthesis.

Table 7.1: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (For the period, 1997-2005) (continued)

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Pooled OLS											
Variables	0.003	(0.46)	0.003	(0.23)	-0.022	(-0.63)	0.013	(2.16)	-0.235	(-5.80)	
Dummy*Variable	-0.008	(-1.82)	0.006	(0.42)	0.003	(0.07)	-0.002	(-0.28)	0.057	(1.45)	0.09
Fixed effects											
Variables	0.003	(0.39)	0.001	(0.09)	-0.021	(-0.73)	0.015	(2.45)	-0.253	(-5.19)	
Dummy*Variable	-0.007	(-1.23)	0.012	(1.30)	-0.003	(-0.09)	-0.005	(-0.65)	0.073	(1.70)	0.30
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Pooled OLS											
Variables	-0.074	(-4.61)	-0.019	(-0.61)	0.018	(0.20)	0.053	(2.96)	-0.322	(-1.32)	
Dummy*Variable	0.032	(1.66)	0.012	(0.37)	0.099	(0.86)	-0.014	(-0.64)	0.256	(1.04)	0.02
Fixed effects											
Variables	-0.073	(-6.86)	-0.030	(-1.29)	0.011	(0.17)	0.065	(4.89)	-0.355	(-1.75)	
Dummy*Variable	0.028	(1.92)	0.032	(1.10)	0.081	(0.72)	-0.014	(-1.19)	0.225	(1.34)	0.25
Panel C: Changes in Book Leverage through Newly Retained Earnings $(-(\Delta RE/A_t))$											
Pooled OLS											
Variables	-0.043	(-1.50)	0.051	(0.72)	0.097	(1.31)	0.017	(1.11)	-0.289	(-1.03)	
Dummy*Variable	0.045	(1.57)	-0.054	(-0.76)	-0.009	(-0.08)	-0.045	(-1.86)	0.303	(1.11)	0.01
Fixed effects											
Variables	-0.051	(-1.21)	0.064	(0.39)	0.154	(2.64)	0.026	(1.58)	-0.421	(-1.31)	
Dummy*Variable	0.054	(1.34)	-0.068	(-0.41)	-0.037	(-0.40)	-0.048	(-1.75)	0.457	(1.51)	0.30

Table 7.1: Baker and Wurgler (2002) filtered data: Determinants of change in book leverage and components (For the period, 1997-2005) (continued)

Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Pooled OLS											
Variables	0.040	(2.12)	0.008	(0.37)	0.029	(0.33)	-0.020	(-2.40)	0.042	(1.13)	0.01
Dummy*Variable	-0.008	(-0.36)	0.012	(0.36)	0.161	(1.52)	0.013	(0.80)	0.010	(0.14)	
Fixed effects											
Variables	0.021	(0.91)	-0.005	(-0.25)	0.045	(0.57)	-0.010	(-0.60)	-0.043	(-0.66)	0.20
Dummy*Variable	0.026	(0.79)	0.018	(0.66)	0.069	(0.70)	-0.001	(-0.04)	0.070	(0.51)	

7.2.2 Unfiltered data

The results of (7.1) for the unfiltered data are recorded in Table 7.2. In Panel A of Table 7.2, using pooled OLS and fixed effects, the market-to-book coefficient for mining firms is significantly different than the coefficient for non-mining firms. It is found that non-mining firms are less sensitive to market-to-book than mining firms. Panel A also shows that the effect of profitability on leverage is unexpectedly strong and significantly different across the two groups of firms. Panel B, C and D of Table 7.2 generally show that the results for mining and non-mining vary significantly with differences in coefficients for asset tangibility, profitability, market-to-book and lagged leverage. But, the effect of profitability on leverage is strong compared to other control variables. From the analysis of the unfiltered data (Table 7.2) there is more evidence of variation between mining and non-mining firms.

7.2.3 Four Standard Deviation filtered data

The mining firm dummy variable is also included in an analysis based on four standard deviation filtered data reported in Table 7.3. Panel A of Table 7.3 shows significant non-mining firm differences for asset tangibility and profitability at the 5% level using pooled OLS and at the 10% level using fixed effects. Non-mining firms are more sensitive than mining firms to asset tangibility. But there is no significant mining firm difference for the market-to-book effect with respect to leverage. Decomposition results reported in Panel B, C and D of Table 7.3 generally show differences between mining and non-mining firm for profitability, firm size and lagged leverage[30]

[30] Sample further divided into mining and non-mining firms to explore the determinants of capital structure and to examine whether the market-to-book effect comes from net equity issues as market timing implies for three filters. Results of these separate regressions are reported in Appendices A7.1, A7.2 and A7.3. These results support that market-to-book effect operates through net equity issues as market timing theory implies.

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Table 7.2: Unfiltered data: Determinants of change in book leverage and components (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used for the model below using unfiltered data set for mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1}$$

$$+ g\left(\frac{M}{B}\right)_{t-1} * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + j\log(S)_{t-1} * Dummy + k\left(\frac{D}{A}\right)_{t-1} * Dummy + u_t$$

Refer to the Table 7.1 for the model and variable definitions. Total 4939 number of observations used in the analysis. Robust t-statistics are in parenthesis.

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Pooled OLS											
Variables	-0.389	(-2.09)	-0.047	(-1.40)	-0.726	(-128.35)	-0.55	(-1.28)	-0.499	(-2.11)	0.54
Dummy*Variable	0.382	(2.07)	0.048	(1.50)	0.724	(102.96)	0.602	(1.43)	-0.466	(-2.00)	
Fixed effects											
Variables	-0.415	(-2.12)	-0.018	(-0.65)	-0.726	(-127.96)	-0.766	(-1.40)	-0.465	(-1.88)	0.62
Dummy*Variable	0.432	(2.04)	0.033	(1.03)	0.736	(32.86)	0.987	(1.62)	-0.546	(-1.97)	
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Pooled OLS											
Variables	0.006	(0.09)	-0.019	(-2.52)	-0.002	(-1.72)	0.084	(3.39)	-0.010	(-0.13)	
Dummy*Variable	-0.045	(-0.74)	0.019	(2.46)	-0.018	(-2.73)	-0.007	(-0.37)	0.055	(0.69)	0.03
Fixed effects											
Variables	0.014	(0.23)	-0.026	(-2.25)	-0.002	(-1.16)	0.091	(3.36)	-0.020	(-0.25)	0.21
Dummy*Variable	-0.053	(-0.86)	0.025	(2.16)	-0.019	(-3.58)	-0.021	(-0.93)	0.057	(0.67)	

Table 7.2: Unfiltered data: Determinants of change in book leverage and components (For the period, 1997-2005) (continued)

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel C: Changes in Book Leverage through Newly Retained Profits $\left(-\left(\Delta RE / A_t\right)\right)$											
Pooled OLS											
Variables	-0.465	(-1.69)	-0.065	(-0.92)	-0.16	(-11.3)	-0.99	(-1.78)	0.584	(1.68)	0.01
Dummy*Variable	0.470	(1.82)	0.056	(0.88)	0.159	(9.84)	0.739	(1.47)	-0.632	(-1.90)	
Fixed effects											
Variables	-0.503	(-1.75)	-0.004	(-0.09)	-0.159	(-11.87)	-1.417	(-1.73)	0.63	(1.73)	0.18
Dummy*Variable	0.528	(1.88)	0.011	(0.23)	0.168	(4.11)	1.418	(1.68)	-0.717	(-1.95)	
Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$											
Pooled OLS											
Variables	0.071	(0.57)	0.038	(1.00)	-0.565	(-56.74)	0.355	(2.14)	-1.072	(-6.83)	0.70
Dummy*Variable	-0.043	(-0.40)	-0.027	(-0.82)	0.584	(39.36)	-0.13	(-1.27)	0.111	(0.74)	
Fixed effects											
Variables	0.073	(0.60)	0.013	(0.55)	-0.565	(-61.70)	0.559	(1.69)	-1.076	(-6.95)	0.76
Dummy*Variable	-0.043	(-0.41)	-0.003	(-0.19)	0.587	(25.19)	-0.409	(-1.37)	0.114	(0.80)	

Table 7.3: Four Standard Deviation filtered data: Determinants of change in book leverage and components (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used for the model below using four standard deviation filtered data for mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1}$$

$$+ g\left(\frac{M}{B}\right)_{t-1} * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + j\log(S)_{t-1} * Dummy + k\left(\frac{D}{A}\right)_{t-1} * Dummy + u_t$$

Refer to the Table 7.1 for the model and variable definitions. Total 4681 number of observations used in the analysis. Robust t-statistics are in parenthesis.

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Pooled OLS											
Variables	-0.009	(-0.62)	0.095	(2.40)	-0.025	(-0.61)	0.024	(1.47)	-0.426	(-1.96)	0.26
Dummy*Variable	0.013	(0.87)	-0.064	(-2.28)	0.088	(1.90)	0.006	(0.24)	-0.120	(-0.49)	
Fixed effects											
Variables	-0.013	(-1.01)	0.104	(2.77)	-0.024	(-0.61)	0.023	(1.49)	-0.420	(-2.12)	0.39
Dummy*Variable	0.018	(1.40)	-0.074	(-1.87)	0.086	(1.81)	0.013	(0.55)	-0.129	(-0.57)	
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Pooled OLS											
Variables	-0.008	(-0.14)	-0.222	(-2.10)	-0.022	(-0.61)	0.065	(1.93)	0.388	(1.07)	0.05
Dummy*Variable	-0.038	(-0.63)	0.190	(1.72)	0.106	(1.83)	0.006	(0.12)	-0.510	(-1.26)	
Fixed effects											
Variables	-0.002	(-0.03)	-0.156	(-1.35)	-0.026	(-0.68)	0.062	(1.60)	0.389	(1.17)	0.21
Dummy*Variable	-0.040	(-0.66)	0.140	(1.17)	0.114	(1.88)	0.003	(0.04)	-0.525	(-1.39)	

Table 7.3: Four Standard Deviation filtered data: Determinants of change in book leverage and components (For the period, 1997-2005) (continued)

Panel C: Changes in Book Leverage through Newly Retained Profit $\left(-\left(\Delta RE / A_t\right)\right)$											
	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Pooled OLS											
Variables	-0.022	(-0.38)	0.123	(0.79)	-0.044	(-0.58)	-0.008	(-0.17)	-1.242	(-1.82)	0.05
Dummy*Variable	0.042	(0.68)	-0.113	(-0.59)	-0.103	(-1.45)	-0.086	(-1.26)	0.859	(1.22)	
Fixed effects											
Variables	-0.024	(-0.49)	0.054	(0.33)	-0.038	(-0.51)	0.002	(0.03)	-1.239	(-1.95)	0.21
Dummy*Variable	0.046	(0.89)	-0.042	(-0.20)	-0.102	(-1.30)	-0.086	(-1.13)	0.858	(1.26)	
Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$											
Pooled OLS											
Variables	0.021	(0.91)	0.194	(2.40)	0.041	(1.19)	-0.033	(-1.81)	0.428	(2.75)	0.02
Dummy*Variable	0.008	(0.37)	-0.141	(-0.93)	0.084	(1.33)	0.086	(3.76)	-0.470	(-2.57)	
Fixed effects											
Variables	0.013	(0.62)	0.207	(2.65)	0.04	(1.11)	-0.04	(-2.22)	0.431	(2.72)	0.18
Dummy*Variable	0.012	(0.47)	-0.174	(-1.08)	0.074	(1.02)	0.097	(4.03)	-0.462	(-2.53)	

7.2.4 Discussion

In this section, a Wald-Coefficient Restriction test is applied to test for significant differences between mining and non-mining firms The results reported in Table 7.4 Panel A for pooled OLS suggest that the estimated coefficients are collectively (all variable*dummy coefficients) significantly different between mining and non-mining firms for the change in leverage regression but there is no significant difference evident in the decomposition equations except for the change in leverage through newly retained profits at the 10% level. However, fixed effect analysis does not show any evidence of significant differences. These results are consistent with the results for the Baker and Wurgler (2002) filtered data reported in Table 7.1.

Panel B provides tests for the unfiltered data where it is found that when coefficients are tested as a group, mining firm coefficients are significantly different than non-mining firm coefficients. These results are consistent with results reported in Table 7.2.

Wald-test results for the four standard deviation filtered data are presented in Panel C of Table 7.4. Similar to the unfiltered data, there is evidence of significant differences between mining and non-mining firm results. These results are consistent with Table 7.3. In a summary, the Baker and Wurgler (2002) filtered data results show little significant difference between mining and non-mining firm but considering the sample which include all firms (unfiltered data) or the sample which just excludes extreme values (four standard deviation filtered data), there are statistically important differences across the broader populations of mining and non-mining firms[31].

[31] Separate regressions for each data filters for mining firm and non-mining firm are provided in Appendices A7.1, A7.2 and A7.3.

Table 7.4: Wald Coefficient tests for equation 7.1

	Pooled OLS model		Fixed effect model	
Panel A: Baker and Wurgler filtered data				
	F-statistic	Probability	F-statistic	Probability
Change in leverage regression (Table 7.1, Panel A)	4.96	0.0002	1.72	0.1254
Change through net equity issues (Table 7.1, Panel B)	0.72	0.6059	1.29	0.2612
Change through newly retained profit (Table 7.1, Panel C)	2.28	0.0542	2.13	0.0582
Change through growth in assets (Table 7.1, Panel D)	1.62	0.2225	0.79	0.5557
Panel B: Unfiltered data				
Change in leverage regression (Table 7.2, Panel A)	5705.58	0.0000	790.10	0.0000
Change through net equity issues (Table 7.2, Panel B)	5.87	0.0000	6.60	0.0000
Change through newly retained profit (Table 7.2, Panel C)	104.04	0.0000	8.92	0.0000
Change through growth in assets (Table 7.2, Panel D)	674.65	0.0000	219.89	0.0000
Panel C: Four Standard Deviation filtered data				
Change in leverage regression (Table 7.3, Panel A)	18.36	0.0000	9.42	0.0000
Change through net equity issues (Table 7.3, Panel B)	8.07	0.0000	3.71	0.0000
Change through newly retained profit (Table 7.3, Panel C)	13.53	0.0000	6.32	0.0000
Change through growth in assets (Table 7.3, Panel D)	5.12	0.0000	12.04	0.0000

7.2.5 EFWAMB and capital structure

The leverage regression including EFWAMB implementing mining dummy variables is also used to test for significant differences in the determinants of leverage for mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} +$$
$$g(EFWAMB)_t * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + f\log(S)_{t-1} * Dummy + u_t \quad (7.2)$$

Here, the dependent variable - leverage - defined in two ways: book value of leverage (book debt to total assets) and market value of leverage (book debt divided by total assets minus book equity plus market value of equity). Other control variables are defined in chapter 3. Again, the first line reported in the result provides estimates of the coefficients that apply to the mining firm and the second line of coefficients refers to the difference in the coefficients (the coefficient for the non-mining firms less the coefficient for the mining firms). Estimated results of 7.2 using each filter are discussed in the following section.

7.2.5.1: Baker and Wurgler (2002) filtered data

The Baker and Wurgler (2002) filtered data results with pooled OLS and the fixed effect analysis reported in Table 7.5 show that mining and non-mining firms differ significantly for both EFWAMB and market-to-book ratio coefficient. There is also a significant difference noted for firm size in case of book leverage. The variable EFWAMB has an impact on the analysis and the impact of the weighted average market-to-book measure on leverage does appear to vary in a more fundamental way between mining and non-mining firms.

Table 7.5: Baker and Wurgler (2002) filtered data: Determinants of book leverage (For the period, 1997-2005)

Mining and Non-mining analysis on book leverage and market leverage with respect to the market-to-book ratio, fixed assets, profitability and firm size using Baker and Wurgler (2002) filtered data including dummy variable. Both pooled OLS and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} +$$

$$g(EFWAMB)^*_t * Dummy + h\left(\frac{PPE}{A}\right)_{t-1} * Dummy + i\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + f\log(S)_{t-1} * Dummy + u_t$$

The intercept, a, is not reported. Total 3595 number of observations used in the analysis. Leverage is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. EFWAMB defined as the external finance weighted average market-to-book ratio from the year 1997 to year t-1. The coefficients from the regression are reported on two separate lines. The first line refers to the coefficients estimated for each variable and the second line refers to the coefficients estimated for the product of the dummy and each variable. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

	$EFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Pooled OLS											
Variables	-0.024	(-8.27)	0.039	(5.54)	0.007	(0.24)	-0.003	(-0.09)	0.078	(22.3)	0.30
Dummy*Variable	0.017	(3.96)	-0.06	(-6.93)	0.025	(0.87)	-0.01	(-0.26)	0.024	(3.70)	
Fixed effects											
Variables	-0.019	(-4.85)	0.038	(3.33)	0.004	(0.23)	-0.026	(-0.53)	0.082	(15.5)	0.47
Dummy*Variable	0.021	(5.03)	-0.060	(-4.56)	0.031	(1.64)	0.002	(0.04)	0.015	(2.41)	
Panel B: Market Leverage											
Pooled OLS											
Variables	-0.027	(-7.28)	-0.050	(-6.52)	-0.001	(-0.06)	-0.062	(-1.98)	0.066	(23.8)	0.31
Dummy*Variable	0.010	(1.91)	-0.030	(-4.38)	0.033	(1.41)	-0.009	(-0.24)	0.0004	(-0.06)	
Fixed effects											
Variables	-0.014	(-3.84)	-0.050	(-6.25)	-0.005	(-0.32)	-0.09	(-2.03)	0.069	(17.74)	0.48
Dummy*Variable	0.008	(1.71)	-0.040	(-3.77)	0.037	(2.56)	0.025	(0.56)	-0.005	(-0.95)	

7.2.5.2 Unfiltered data

Unfiltered data analysis, using equation (7.2), is reported in Table 7.6. It is found that there is a significant difference between mining and non-mining firms for profitability at the 1% level especially in case of book leverage using both pooled OLS and fixed effect model. For market leverage both pooled OLS and fixed effect models exhibit significant differences between mining and non-mining firms for both EFWAMB and market-to-book coefficients. Again, the addition of the EFWAMB variable has an important effect on industry capital structure choice.

7.2.5.3 Four Standard Deviation filtered data

The results from of the four standard deviation filtered data with pooled OLS results, reported in Table 7.7, show a significant difference between mining and non-mining firms for market-to-book, tangibility with respect to book leverage, and for market-to-book and firm size with respect to market leverage. Fixed effect results are somewhat different though the parameter signs are similar to those from the pooled OLS results. However, the results documented for this filter show no significant difference in terms of EFWAMB effect.[32]. This is quite different from the results reported for the Baker and Wurgler (2002) filtered data and the unfiltered data. This provides some indication of how sensitive this analysis can be to variable choice. There is heavier loading on lagged market-to-book variable for mining verses non-mining coefficient compares for this data filters.

[32]Mining and non-mining results in Appendix A7.5 suggest though there are statistically significant differences in the coefficients of two different samples but both these firms show that EFWAMB and market-to-book are important in explaining the variation in leverage. Appendix A7.6 show that profitability tends to reduce leverage for mining firms where it has insignificant positive effect on leverage for non-mining firm. Further analysis exhibit insignificant positive and negative relationship between EFWAMB and book leverage for mining and non-mining respectively (Appendix A7.7). Overall, A7.5, A7.6 and A7.7 results are similar as noted in chapter 5.

Table 7.6: Unfiltered data: Determinants of book leverage (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used for the model below using unfiltered data set for mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + gDummy*(EFWAMB)_t$$

$$+ hDummy*\left(\frac{M}{B}\right)_{t-1} + iDummy*\left(\frac{PPE}{A}\right)_{t-1} + jDummy*\left(\frac{EBITDA}{A}\right)_{t-1} + kDummy*\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. Total 4939 number of observations used in the analysis. Leverage is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. External finance weighted average market-to-book ratio (EFWAMB), defined as the weighted average market-to-book ratio from the year 1997 to year t-1. The coefficients from the regression are reported on two separate lines. The first line refers to the coefficients estimated for each variable and the second line refers to the coefficients estimated for the product of the dummy and each variable. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

	$EFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Pooled OLS											
Variables	-0.029	(-2.13)	0.002	(0.41)	-0.047	(-1.43)	-0.715	(-19.03)	-0.393	(-1.09)	0.33
Dummy*Variable	0.024	(1.84)	0.001	(0.24)	0.048	(1.53)	0.718	(17.63)	0.451	(1.28)	
Fixed effects											
Variables	-0.032	(-2.81)	0.002	(0.42)	-0.025	(-0.93)	-0.714	(-17.11)	-0.603	(-1.28)	0.44
Dummy*Variable	0.015	(0.17)	0.014	(1.27)	0.040	(1.20)	0.723	(11.83)	0.817	(1.56)	
Panel B: Market Leverage											
Pooled OLS											
Variables	-0.002	(-1.94)	0.0001	(0.69)	0.002	(0.29)	-0.001	(-5.34)	0.072	(9.95)	0.28
Dummy*Variable	-0.013	(-5.76)	-0.010	(-1.84)	0.003	(0.38)	-0.002	(-1.23)	0.005	(1.89)	
Fixed effects											
Variables	-0.001	(-1.48)	0.0001	(1.20)	0.001	(0.28)	-0.001	(-5.72)	0.071	(31.45)	0.47
Dummy*Variable	-0.010	(-4.48)	-0.010	(-2.08)	0.004	(0.63)	-0.002	(-1.47)	0.005	(1.85)	

Table 7.7: Four Standard Deviation filtered data: Determinants of book leverage (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used for the model below using four standard deviation filtered data for mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + gDummy*(EFWAMB)_t$$

$$+ hDummy*\left(\frac{M}{B}\right)_{t-1} + iDummy*\left(\frac{PPE}{A}\right)_{t-1} + jDummy*\left(\frac{EBITDA}{A}\right)_{t-1} + kDummy*\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. Total 4681 number of observations used in the analysis. Leverage is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. External finance weighted average market-to-book ratio (EFWAMB), defined as the weighted average market-to-book ratio from the year 1997 to year t-1. The coefficients from the regression are reported on two separate lines. The first line refers to the coefficients estimated for each variable and the second line refers to the coefficients estimated for the product of the dummy and each variable. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

	$EFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Pooled OLS											
Variables	0.007	(0.76)	0.046	(3.69)	0.124	(3.26)	-0.019	(-0.43)	0.078	(9.81)	0.09
Dummy*Variable	-0.007	(-0.93)	-0.040	(-2.81)	-0.055	(-2.67)	-0.02	(-0.53)	0.005	(0.56)	
Fixed effects											
Variables	0.011	(1.48)	0.041	(3.34)	0.127	(2.92)	-0.017	(-0.4)	0.077	(9.49)	0.24
Dummy*Variable	-0.012	(-1.73)	-0.030	(-2.42)	-0.059	(-1.41)	-0.022	(-0.56)	0.012	(1.13)	
Panel B: Market Leverage											
Pooled OLS											
Variables	-0.003	(-3.79)	-0.010	(-4.19)	0.104	(5.91)	-0.002	(-1.71)	0.061	(36.87)	0.30
Dummy*Variable	0.0003	(0.10)	-0.010	(-2.04)	-0.012	(-0.65)	-0.010	(-1.27)	0.009	(2.78)	
Fixed effects											
Variables	0.002	(1.04)	-0.010	(-4.05)	0.099	(7.03)	-0.003	(-1.51)	0.062	(27.97)	0.45
Dummy*Variable	-0.003	(-1.16)	-0.010	(-1.16)	-0.012	(-0.61)	-0.012	(-2.07)	0.009	(2.37)	

7.2.5.4 Discussion

The results obtained from analysis of mining and non-mining firms suggest rejection of the null hypothesis in all cases which suggest there are industry effects in the data. Wald-Coefficient restriction tests are used to test for significant differences between mining and non-mining firm coefficients and these are reported in Table 7.8.

Table 7.8: Wald Coefficient tests for regression equation 7.2

	Pooled OLS model		**Fixed effect model**	
Panel A: Baker and Wurgler filtered data				
	F-statistic	Probability	F-statistic	Probability
Table 7.5, Panel A: Book leverage	34.58	0.0000	34.42	0.0000
Table 7.5, Panel B: Market leverage	12.92	0.0000	5.65	0.0000
Panel B: Unfiltered data				
Table 7.6, Panel A: Book leverage	39188.84	0.0000	9438.54	0.0000
Table 7.6, Panel B: Market leverage	19.68	0.0000	31.32	0.0000
Panel C: Four standard deviation filtered data				
Table 7.7, Panel A: Book leverage	17.42	0.0000	30.26	0.0000
Table 7.7, Panel B: Market leverage	16.65	0.0000	3.09	0.0000

Wald-test results reported in Table 7.8 support the hypothesis that the mining and non-mining firm coefficients vary significantly. There is statistically significant variation between mining and non-mining firm using all three data sets though the individual coefficient significance varies with data filter choice, particularly for market-to-book based variables. These results are broadly consistent with the results reported in Tables 7.5, 7.6 and 7.7[33].

[33] The result suggests that the effect of market timing in Australian firms (mining and non-mining firms) is not as persistent as it is for US firms (reported in appendix A7.5, A7.6 and A7.7) though it finds that higher valuation in the market does result in equity issues. This supports the argument that a high market-to-book ratio is associated with debt reduction but the effect is not long lasting (Frank & Goyal 2004).

7.3 GROWTH OPPORTUNITIES AND CAPITAL STRUCTURE

In this section, the Hovakimian (2006) model is re-estimated (equation 3.7, 6.3, 3.11 and 3.12) including mining dummy variables to test for significant differences between mining and non-mining firm when EFWAMB is included in the model. As the study yields no new conclusions for the baseline regression (3.6 or 6.1), these base line results are not reported separately here.

7.3.1 Market-timing and leverage

The equation 3.7 is re-estimated to test for significant difference between mining and non-mining firms. The equation takes the following form:

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1}$$
$$+ i(EFWAMB)^*_t * Dummy + j\left(\frac{M}{B}\right)_{t-1} * Dummy + k\left(\frac{PPE}{A}\right)_{t-1} * Dummy + l\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + m\log(S)_{t-1} * Dummy$$
$$+ n(EqIs)_{t-1} * Dummy + o(DbIs)_{t-1} * Dummy + u_t$$

(7.3)

In equation (7.3) following Hovakimian (2006), leverage is defined as the long-term debt plus short-term debt over total assets for the period t. EqIs and DbIs refer to the cumulative net equity issued and the cumulative net debt issued respectively[34].

Baker and Wurgler (2002) filtered data results are reported in Table 7.9, Panel A. It is apparent that the estimated coefficients differ significantly for the effect of EFWAMB*, market-to-book, profitability and cumulative net debt issues between mining and non-mining. It seems that non-mining firms are less sensitive to EFWAMB* and profitability where mining firms are less sensitive to market-to-book[35]. The unfiltered data results are reported in Table 7.9, Panel B. For both pooled

[34] Please refer to chapter 3 and 6 for the definition of EFWAMB*, EqIs and DbIs

[35] In addition, sample has been separated into mining and non-mining firm to find support that EFWAMB* contains the information for growth opportunities documented in chapter 6. It is found that the effect of DbIs on leverage (0.268) and (0.146) for mining and non-mining respectively, is statistically much stronger than the effect of EqIs (-0.014) for mining and (-0.012) for non-mining on

OLS and fixed effect analysis it is found that the profitability coefficient varies significantly between mining and non-mining firms. But there are no significant difference noted for remaining control variables[36].

Equation (7.3) is also re-estimated using the four standard deviation filtered data and the results are reported in Table 7.9, Panel C. For both pooled OLS and fixed effects, the EFWAMB* coefficient differs significantly between mining and non-mining firms. The effect of firm size also differs between mining and non-mining when the fixed effect model is used. And, the effect of DbIs varies significantly when pooled OLS is used.[37] Overall, the results in Table 7.9 suggest that there are industry differences in each of the models though the variety in these differences with change in data filter is perhaps the most important observation that can be taken from this analysis.

7.3.2 Determinants of changes in leverage

The change in leverage regression (6.3) is re-estimated using the dummy variables for all filters to again test for significant differences between mining and non-mining firm leverage determinants. Lagged leverage is included in the model as an independent variable to be consistent with previous research (Baker & Wurgler 2002). Hovakimian (2006) argued that if past market-to-book ratio is a proxy for past market timing then it will have no effect on changes in current leverage but if it is associated with growth opportunities, it will have significant impact on current capital financing decisions.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1}$$
$$+ h(EFWAMB)^*_t * Dummy + i\left(\frac{M}{B}\right)_{t-1} * Dummy + j\left(\frac{PPE}{A}\right)_{t-1} * Dummy + k\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy$$
$$+ l\log(S)_{t-1} * Dummy + m\left(\frac{LT+ST}{A}\right)_{t-1} * Dummy + u_t$$

(7.4)

---

leverage. The result is consistent with the findings of Hovakimian (2006) but not consistent with the market timing hypothesis (Appendix A7.8, Panel A).

[36] Further, unfiltered data show that the effect of EFWAMB is insignificant on leverage, consistent with the previous result (chapter 6, Table 6.3, Panel B). See Appendix A7.8, Panel B.

[37] As the results imply that the significant difference occurs especially in case of EFWAMB effect, it is also found that, for mining firm the effect of EFWAMB is significant and this effect remains insignificant for non-mining firm (See Appendix A7.8, Panel C).

Table 7.9: Determinants of book leverage: All Filters (For the period, 1997-2005)

Both pooled ordinary least squares (OLS) and fixed effects panel analysis are used below for the analysis on leverage with respect to the market-to-book ratio, fixed assets, profitability, firm size, cumulative net debt and cumulative net equity issued for all filters using dummy variable for mining and non-mining firms.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1} + i(EFWAMB)^*_t * Dummy$$
$$+ j\left(\frac{M}{B}\right)_{t-1} * Dummy + k\left(\frac{PPE}{A}\right)_{t-1} * Dummy + l\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + m\log(S)_{t-1} * Dummy + n(EqIs)_{t-1} * Dummy + o(DbIs)_{t-1} * Dummy + u_t$$

The intercept, a, is not reported. Here, leverage is defined as, $\left(LT + ST/A\right)$, long-term debt + short-term debt over total assets. The EFWAMB* is external finance weighted average market-to-book ratio. The market-to-book ratio is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility is defined as net property, plant and equipment divided by assets. Profitability is defined as operating income before interest, taxes, depreciation and amortization divided by total assets. Firm size is defined as the log of total revenue. Cumulative net equity issued is, $(EqIs)$, the net equity issued divided by total assets cumulated over all years preceding the current year and cumulative net debt issued is, $(DbIs)$, the net debt issued divided by total assets cumulated over all years preceding the current year (net debt issued is measured as the change in long term plus short term debt). The coefficients from the regression are reported on two separate lines. The first line refers to the coefficients estimated for each variable and the second line refers to the coefficients estimated for the product of the dummy and each variable. Robust t-statistics are in parenthesis.

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$EqIs$		$DbIs$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel A: Baker Wurgler filter (N=3595)															
Pooled OLS															
Variables	-0.012	(-4.79)	0.017	(1.66)	0.011	(0.46)	-0.103	(-2.02)	0.04	(7.62)	-0.014	(-1.01)	0.268	(5.85)	0.22
Dummy*Variable	0.007	(2.87)	-0.036	(-2.93)	0.038	(0.93)	0.099	(2.47)	0.005	(0.74)	0.002	(0.17)	-0.121	(-2.08)	
Fixed effects															
Variables	-0.003	(-0.64)	0.017	(1.67)	0.002	(0.11)	-0.104	(-3.26)	0.042	(10.2)	0.006	(0.33)	0.258	(5.64)	0.42
Dummy*Variable	0.004	(1.20)	-0.035	(-3.14)	0.048	(1.33)	0.094	(3.77)	0.003	(0.79)	-0.015	(-0.83)	-0.099	(-1.71)	

Table 7.9: Determinants of book leverage: All Filters (For the period, 1997-2005) (continued)

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		*EqIs*		*DbIs*		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel B: Unfiltered (N=4939)															
Pooled OLS															
Variables	-0.002	(-0.06)	-0.002	(-1.05)	-0.034	(-1.05)	-0.707	(-12.4)	-0.056	(-0.34)	-0.020	(-0.49)	0.023	(0.10)	0.60
Dummy*Variabl	0.002	(0.08)	0.001	(0.02)	0.039	(1.21)	0.705	(10.79)	0.010	(0.61)	0.021	(0.49)	-0.011	(-0.05)	
Fixed effects															
Variables	0.004	(0.14)	-0.003	(-1.05)	-0.027	(-1.26)	-0.705	(-10.9)	-0.215	(-0.73)	-0.029	(-0.65)	-0.016	(-0.07)	0.68
Dummy*Variabl	0.001	(0.04)	0.0004	(-0.04)	0.033	(1.47)	0.709	(9.94)	0.315	(0.94)	0.028	(0.64)	0.088	(0.44)	
Panel C: Four Standard Deviation filter (N=4681)															
Pooled OLS															
Variables	0.029	(2.42)	0.005	(0.72)	0.089	(2.55)	-0.02	(-0.47)	0.033	(5.14)	0.0001	(5.49)	0.012	(2.70)	0.07
Dummy*Variabl	-0.029	(-2.51)	-0.01	(-1.24)	0.051	(1.05)	0.005	(0.14)	0.010	(1.50)	-0.004	(-1.26)	-0.013	(-2.41)	
Fixed effects															
Variables	0.035	(2.98)	-0.001	(-0.07)	0.082	(2.20)	-0.018	(-0.46)	0.033	(4.41)	0.002	(0.82)	0.001	(0.21)	0.23
Dummy*Variabl	-0.031	(-2.89)	-0.006	(-0.68)	0.055	(1.15)	0.004	(0.1)	0.011	(1.98)	0.001	(-0.06)	-0.004	(-0.44)	

In (7.4) the dependent variable, change in leverage, is defined as leverage at time (t) minus leverage at time (t-1). The other control variables are defined in chapter 3. The results from the change in leverage regression are reported in Table 7.10 using all filters.

Both pooled OLS and fixed effect analysis suggest significant differences exist between mining and non-mining firms especially for market-to-book, profitability and lagged leverage where the results vary at 10% to 1% significance level.

From the Baker and Wurgler (2002) filtered data (Panel A), it is found that non-mining firms are less sensitive to EFWAMB* using the pooled OLS model and less sensitive to profitability using fixed effect model relative to mining firms. Similar to the previous analysis, unfiltered data results (Panel B) show that the effect of profitability is strong and significantly different for mining and non-mining. It is also evident from Panel B that there are significant differences, between mining and non-mining firm at 1% significant level in terms of market-to-book and lagged leverage effect. However, there is no significant difference among mining and non-mining firms except for profitability (pooled OLS result) when a four standard deviation filtered data is used (Panel C)[38]. Again, the critical point of this analysis is the variation in results with data filter choice.

[38] Result are consistent with the Hovakimian (2006) hypothesis that EFWAMB* contains the information for growth opportunities (See appendix A7.9).

Table 7.10: Determinants of changes in book leverage: All Filters (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used below for the analysis on changes in leverage.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + hDummy^*(EFWAMB)^*_t$$
$$+ iDummy^*\left(\frac{M}{B}\right)_{t-1} + jDummy^*\left(\frac{PPE}{A}\right)_{t-1} + kDummy^*\left(\frac{EBITDA}{A}\right)_{t-1} + lDummy^*\log(S)_{t-1} + mDummy^*\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

Refer to the Table 7.9 for variable definitions. Change in leverage is defined as leverage at time (t) minus leverage at time (t-1). Robust t-stats are in parenthesis.

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker Wurgler filtered data (N=3595)													
Pooled OLS													
Variables	-0.009	(-4.07)	0.012	(1.40)	0.003	(0.25)	-0.044	(-1.43)	0.014	(2.63)	-0.375	(-4.19)	0.14
Dummy*Variable	0.005	(1.77)	-0.015	(-1.53)	0.013	(0.68)	0.041	(1.48)	-0.003	(-0.43)	0.109	(1.08)	
Fixed effects													
Variables	-0.004	(-1.19)	0.011	(1.16)	-0.002	(-0.17)	-0.054	(-2.18)	0.015	(3.46)	-0.386	(-4.25)	0.35
Dummy*Variable	0.001	(0.22)	-0.013	(-1.27)	0.021	(1.17)	0.044	(2.36)	-0.003	(-0.64)	0.117	(1.15)	
Panel B: Unfiltered data (N=4939)													
Pooled OLS													
Variables	-0.037	(-1.58)	0.002	(0.38)	-0.036	(-1.16)	-0.682	(-45.70)	-0.063	(-0.4)	-0.917	(-19.30)	0.61
Dummy*Variable	0.034	(1.40)	-0.012	(-2.04)	0.039	(1.28)	0.675	(44.6)	0.092	(0.59)	0.158	(2.31)	
Fixed effects													
Variables	-0.035	(-1.5)	0.001	(0.35)	-0.028	(-1.28)	-0.682	(-44.1)	-0.221	(-0.76)	-0.922	(-19.8)	0.69
Dummy*Variable	0.028	(1.14)	-0.018	(-1.25)	0.031	(1.43)	0.671	(33.1)	0.307	(0.95)	0.294	(1.65)	
Panel C: Four Standard Deviation filtered data (N=4681)													
Pooled OLS													
Variables	0.001	(0.13)	-0.008	(-0.78)	0.055	(1.85)	-0.025	(-0.58)	0.015	(2.02)	-0.450	(-2.03)	0.28
Dummy*Variable	-0.001	(-0.12)	0.005	(0.50)	-0.002	(-0.03)	0.062	(1.66)	0.006	(0.47)	-0.182	(-0.76)	
Fixed effects													
Variables	0.004	(0.62)	-0.013	(-1.37)	0.057	(1.91)	-0.022	(-0.56)	0.015	(2.15)	-0.445	(-2.22)	0.40
Dummy*Variable	-0.002	(-0.33)	0.009	(0.90)	-0.004	(-0.05)	0.057	(1.48)	0.009	(0.85)	-0.202	(-0.92)	

7.3.3 Future market-to-book/market timing and leverage

In this section, following Hovakimian (2006), the leverage regression is estimated as well as the change in leverage regression with EFWAMB* based on future rather than past market-to-book ratios and external finance (equations 3.11 and 3.12). Hovakimian (2006) argued that if firm growth opportunities change slowly, then both EFWAMB* and FEFWAMB will be the proxies for long-term growth opportunities and that is why he substitutes FEFWAMB for the EFWAMB*. The result of the following regression is reported in Table 7.11.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g(FEFWAMB)_t * Dummy + h\left(\frac{M}{B}\right)_{t-1} * Dummy + i\left(\frac{PPE}{A}\right)_{t-1} * Dummy + j\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy$$
$$+ k\log(S)_{t-1} * Dummy + u_t$$

(7.5)

The Baker and Wurgler (2002) filtered results in Table 7.11 Panel A, show that mining and non-mining firm results are significantly different for market-to-book and profitability using both pooled OLS and fixed effect models. It is found that mining firms are less sensitive to market-to-book and non-mining firms are less sensitive to profitability. Further, unfiltered data and a four standard deviation filtered data results (reported in Table 7.11 Panel B and C respectively) also exhibit significant differences in mining and non-mining firm coefficients. While the unfiltered data records a strong and significant difference for profitability, the four standard deviation filtered data exhibits variation in both market-to-book and asset tangibility. The significant difference in the effect for profitability using unfiltered data is consistent with previous analyses. However, regardless of the filters choice, there is no significant difference is evident between mining and non-mining firms for the FEFWAMB coefficients[39].

[39] Further analysis by separating the sample into mining and non-mining suggest that the findings are consistent with Hovakimian (2006) and the hypothesis that the significant impact of future market-to-book ratio on capital structure reflects growth opportunities rather than equity market timing (Appendix A7.9).

Table 7.11: Future EFWAMB and capital structure: All Filters (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used below for the analysis on leverage.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(FEFWAMB)_t * Dummy$$

$$+ h\left(\frac{M}{B}\right)_{t-1} * Dummy + i\left(\frac{PPE}{A}\right)_{t-1} * Dummy + j\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + k\log(S)_{t-1} * Dummy + u_t$$

Refer to the Table 7.9 for variable definitions. The FEFWAMB is external finance weighted average of future market-to-book ratio. Robust t-stats are in parenthesis.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Baker Wurgler filter (N=3595)											
Pooled OLS											
Variables	-0.007	(-1.48)	0.020	(2.55)	0.010	(0.45)	-0.122	(-1.93)	0.036	(5.25)	0.14
Dummy*Variable	0.001	(0.19)	-0.040	(-3.83)	0.041	(1.03)	0.154	(3.56)	0.011	(1.32)	
Fixed effects											
Variables	-0.008	(-0.99)	0.027	(2.60)	-0.002	(-0.11)	-0.143	(-2.66)	0.040	(7.47)	0.36
Dummy*Variable	-0.001	(-0.06)	-0.040	(-3.73)	0.055	(1.51)	0.164	(4.36)	0.008	(1.70)	
Panel B: Unfiltered (N=4939)											
Pooled OLS											
Variables	-0.002	(-1.51)	-0.001	(-0.82)	-0.038	(-1.10)	-0.706	(-235.22)	-0.102	(-0.53)	0.60
Dummy*Variable	-0.002	(-1.55)	-0.001	(-0.77)	0.042	(1.24)	0.703	(196.00)	0.146	(0.77)	
Fixed effects											
Variables	-0.003	(-1.64)	-0.001	(-0.73)	-0.029	(-1.21)	-0.705	(-212.99)	-0.309	(-0.85)	0.68
Dummy*Variable	-0.008	(-1.20)	-0.003	(-0.28)	0.036	(1.36)	0.701	(79.82)	0.437	(1.05)	
Panel C: Four Standard Deviation filter (N=4681)											
Pooled OLS											
Variables	-0.011	(-2.13)	0.048	(2.06)	0.046	(1.29)	-0.022	(-0.52)	0.041	(5.18)	0.06
Dummy*Variable	0.006	(1.14)	-0.050	(-2.22)	0.090	(1.98)	0.001	(0.01)	0.003	(0.44)	
Fixed effects											
Variables	-0.015	(-2.53)	0.047	(2.04)	0.040	(1.05)	-0.021	(-0.52)	0.043	(4.39)	0.21
Dummy*Variable	0.009	(1.36)	-0.050	(-2.19)	0.097	(2.29)	-0.005	(-0.09)	0.004	(0.64)	

7.3.4 Future market-to-book and changes in leverage

In this section, the study re-estimates the change in leverage regression with FEFWAMB (3.12). The objective is to see whether there is significant difference in the results for mining and non-mining firms and to see the effect of FEFWAMB on change in leverage. The results of the analysis are reported in Table 7.12.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g\left(\frac{LT+ST}{A}\right)_{t-1} + h(FEFWAMB)_t * Dummy + i\left(\frac{M}{B}\right)_{t-1} * Dummy + j\left(\frac{PPE}{A}\right)_{t-1} * Dummy$$
$$+ k\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + l\log(S)_{t-1} * Dummy + m\left(\frac{LT+ST}{A}\right)_{t-1} * Dummy + u_t$$

(7.6)

Table 7.12 reports that some variation exists in the coefficients estimated for mining and non-mining firms for market-to-book, profitability, lagged leverage and firm size in general. The Baker and Wurgler (2002) filtered data results in Panel A, with both pooled OLS and fixed effects, show that non-mining firms are less sensitive to lagged leverage and only the fixed effect model identifies differences for profitability. The unfiltered data results in Panel B show that mining firms are less sensitive to market-to-book when pooled OLS is used and mining firms are less sensitive to lagged leverage regardless of the estimation method. Four standard deviation filtered data (Panel C) show that the estimated coefficients vary significantly between mining and non-mining firm for firm size using both models and for FEFWAMB using pooled OLS model. In all cases the null hypothesis that mining and non-mining firm coefficient do not vary is rejected[40].

[40] There are statistically significant effects noted for FEFWAMB in the change in leverage especially for non-mining firms (the only exception is the fixed effect specification results using unfiltered data set). (Appendix A7.11). Thus the results are consistent with those of Hovakimian (2006).

Table 7.12: Changes in book leverage with Future EFWAMB: All Filters (For the period, 1997-2005)

Both pooled OLS and fixed effects panel analysis are used below for the analysis on changes in leverage.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + h(FEFWAMB)_t * Dummy$$
$$+ i\left(\frac{M}{B}\right)_{t-1} * Dummy + j\left(\frac{PPE}{A}\right)_{t-1} * Dummy + k\left(\frac{EBITDA}{A}\right)_{t-1} * Dummy + l\log(S)_{t-1} * Dummy + m\left(\frac{LT+ST}{A}\right)_{t-1} * Dummy + u_t$$

Refer to the Table 7.9 for variable definitions. The FEFWAMB is external finance weighted average of future market-to-book ratio. Robust t-stats are in parenthesis.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker Wurgler filter (N=3595)													
Pooled OLS													
Variables	-0.001	(-0.54)	0.002	(0.18)	-0.001	(-0.10)	-0.045	(-1.20)	0.005	(1.51)	-0.23	(-10.32)	0.07
Dummy*Variable	-0.001	(-0.22)	-0.004	(-0.39)	0.013	(0.90)	0.051	(1.27)	-0.001	(-0.16)	0.053	(1.80)	
Fixed effects													
Variables	-0.003	(-0.71)	0.003	(0.32)	-0.008	(-0.79)	-0.059	(-2.16)	0.008	(1.89)	-0.245	(-9.09)	0.27
Dummy*Variable	-0.001	(-0.16)	-0.003	(-0.36)	0.023	(1.62)	0.058	(1.72)	-0.002	(-0.54)	0.064	(1.63)	
Panel B: Unfiltered (N=4939)													
Pooled OLS													
Variables	-0.002	(-1.42)	-0.002	(-0.95)	-0.03	(-0.84)	0.08	(0.4)	-0.232	(-1.01)	0.375	(1.06)	0.05
Dummy*Variable	-0.0003	(-0.21)	-0.014	(-4.68)	0.032	(0.93)	-0.076	(-0.38)	0.256	(1.14)	-1.084	(-3.11)	
Fixed effects													
Variables	-0.003	(-1.62)	-0.002	(-0.95)	-0.02	(-0.79)	0.091	(0.47)	-0.441	(-1.11)	0.391	(1.16)	0.25
Dummy*Variable	-0.004	(-0.65)	-0.028	(-1.25)	0.024	(0.96)	-0.083	(-0.44)	0.53	(1.21)	-0.864	(-3.50)	

Table 7.12: Changes in book leverage with Future EFWAMB: All Filters (For the period, 1997-2005) (continued)

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel C: Four Standard Deviation filter (N=4681)													
Pooled OLS													
Variables	0.0004	(0.33)	-0.003	(-0.62)	0.054	(2.03)	-0.023	(-0.54)	0.007	(1.13)	-0.307	(-1.51)	0.21
Dummy*Variable	-0.004	(-2.42)	-0.002	(-0.30)	-0.009	(-0.14)	0.036	(0.76)	0.020	(2.04)	-0.336	(-1.40)	
Fixed effects													
Variables	-0.001	(-0.58)	-0.005	(-0.98)	0.054	(2.22)	-0.022	(-0.54)	0.007	(1.08)	-0.298	(-1.59)	0.34
Dummy*Variable	-0.002	(-0.69)	0.0002	(0.03)	-0.005	(-0.08)	0.030	(0.62)	0.022	(2.63)	-0.363	(-1.59)	

7.4 DISCUSSION

The results of the Hovakimian (2006) analyses show that there are significant differences in the coefficients for mining and non-mining firms. While these differences exist, coefficient statistical significance varies considerably with model specification and estimation method. The Wald-test results for differences between mining and non-mining firms using Hovakimian (2006) models are shown in Table 7.13 below.

Table 7.13: Wald Coefficient tests Hovakimian (2006) models

	Pooled OLS model		**Fixed effect model**	
Panel A: Baker and Wurgler filtered data				
	F-statistic	P	F-statistic	P
Leverage regression (Table 7.9, Panel A)	163.14	0.0000	33.16	0.0000
Change in leverage regression (Table 7.10, Panel A)	8.97	0.0000	8.75	0.0000
Leverage regression with FEFWAMB (Table 7.11, Panel A)	56.55	0.0000	33.15	0.0000
Change in leverage regression (Table 7.12, Panel A)	20.26	0.0000	4.28	0.0003
Panel B: Unfiltered data				
Leverage regression (Table 7.9, Panel B)	618.8	0.0000	677.7	0.0000
Change in leverage regression (Table 7.10, Panel B)	123.4	0.0000	187.7	0.0000
Leverage regression with FEFWAMB (Table 7.11, Panel B)	180.9	0.0000	503.3	0.0000
Change in leverage regression (Table 7.12, Panel B)	12.69	0.0000	49.33	0.0000
Panel C: Four Standard Deviation filtered data				
Leverage regression (Table 7.9, Panel C)	8.08	0.0000	8.06	0.0000
Change in leverage regression (Table 7.10, Panel C)	2.91	0.0080	1.50	0.1747
Leverage regression with FEFWAMB (Table 7.11, Panel C)	3.48	0.0039	1.89	0.0931
Change in leverage regression (Table 7.12, Panel C)	13.01	0.0000	6.07	0.0000

The Wald-test results in Table 7.13 show that there are statistically significant differences between mining and non-mining firms. However, the fixed effect model of four standard deviation filtered data results in Panel C of Table 7.10 shows no significant differences in some cases. These results are consistent with that of Tables 7.9, 7.10, 7.11 and 7.12.

In a summary, though analyses following Hovakimian (2006) identify mining firm and non-mining firm coefficient differences, further analysis (reported in appendix) supports the hypothesis that, EFWAMB has a significant impact on current leverage and change in leverage level, consistent with earlier chapters. Further, when the weighted average future market-to-book ratio replaces weighted average of past market-to-book ratios the relationship between the weighted average market-to-book and leverage remains.

7.5 CONCLUSION

Initial results obtained from Baker and Wurgler (2002) market timing model show little difference between mining and non-mining firms when applied to the Baker and Wurgler (2002) filtered data. In particular, mining firms show little evidence of sensitivity to market-to-book effect on leverage. When unfiltered data are used, significant differences are noted between mining and non-mining firm for various control variables including the market-to-book coefficients. Further, when the four standard deviation filtered data is used, it is found that, except for market-to-book, there are significant differences between mining and non-mining firm results. Hence, sample selection has an impact on this analysis. Further, Wald-tests for the Baker and Wurgler (2002) analysis of mining and non-mining reject the null of no difference. There appears to be a broad industry differences in the data, though the results are broadly consistent with those reported in chapter 5.

Finally, while examining the Hovakimian (2006) hypothesis that EFWAMB contains information about growth opportunities, significant differences between mining and non-mining are also evident. Overall, analysis of the original Baker and Wurgler (2002) and Hovakimian (2006) models show significant differences for mining and non-mining firms. Thus, the important contribution of this analysis is that it identifies variation in the results with different data filter choice though further analysis shows that growth opportunities provide reasonable explanation for the past market-to-book ratio effect for Australian mining and non-mining firms.

CHAPTER 8

LIQUIDITY AND CAPITAL STRUCTURE

8.1 INTRODUCTION

As discussed in preceding chapters, the persistent impact of market timing on capital structure evidence in Baker and Wurgler (2002) has given the rise to a number of studies. First, as outlined in chapter 5, the theory of market timing appears to have impact on capital structure evidenced by significant negative relationship between market-to-book and leverage but analysis of Australian data does not support the hypothesis that past market timing decisions has a long lasting impact on firm capital structure. Second, as reported in chapter 6, empirical evidence suggests that historical average/past market-to-book and leverage are significantly related, not due to equity market timing, but because it contains information about growth opportunities. As argued by Hovakimian (2006), external finance weighted average market-to-book or past market timing is related to the current leverage because it complements the current market-to-book ratio as a proxy for growth opportunities. Third, and as outlined in chapter 7, there are significant differences noted between mining and non-mining firm capital structure decision. Although the issue of the difference in the outcome between mining and non-mining firm has been studied in other areas of research, there appears to be a lack of empirical evidence in the area of capital structure.

In addition to these issues that provide the central focus for the investigations outlined and reported in the preceding chapters, there is another research issue that has been investigated. Recent studies have suggested and highlighted the importance of the role of liquidity for corporate decision making, which has a significant impact on capital structure. For example, Amihud and Mandelson (1986a), Barclay, Kandel and Marx (1998), Leary and Roberts (2005) and others, all report a relation between liquidity and capital structure decisions. While most empirical studies explain the importance of liquidity in the capital structure decision with respect to US firms, this chapter investigates the issue using Australian data. In their notable studies, Amihud and Mandelson (1986b; 1986a) report that

expected returns are highly sensitive to changes in transaction costs. Moreover, they argue that, in equilibrium, investors hold illiquid assets over longer investment horizons. As a result, they argued that the observed asset returns are a concave function of transaction costs. These findings are supported by other investigations (Datar, Naik & Radcliffe 1998; Grossman & Miller 1988).

In this chapter, bid-ask spread, volume of trade and zero returns (proposed by Lesmond, Ogden and Trzcinka (1999)) are used as a proxies for liquidity using Australian data within the Baker and Wurgler (2002) and Hovakimian (2006) testing framework. The reminder of the chapter is structured as follows. Section 8.2 outlines the data and summary statistics, Section 8.3 discuss the results of the investigation and Section 8.4 contains the summary of the findings or conclusion.

8.2 DATA AND SUMMARY STATISTICS

Data employed in this chapter are derived from previous chapters (5, 6 and 7) and discussed in chapter 4. DataStream is the source of data for the three measures of liquidity that are discussed in chapter 4. However, DataStream does not provide adequate coverage of the data especially for bid and ask prices before 2001. Thus, analysis in this chapter focuses on liquidity effect over the period from 2001 to 2005. The sample size remains at 1438 companies for the unfiltered data, 1146 companies for the four standard deviation filtered data and 981 companies for the Baker and Wurgler (2002) filtered data though firm year observations are reduced[41] in line with the shorter sample period from 2001 to 2005.

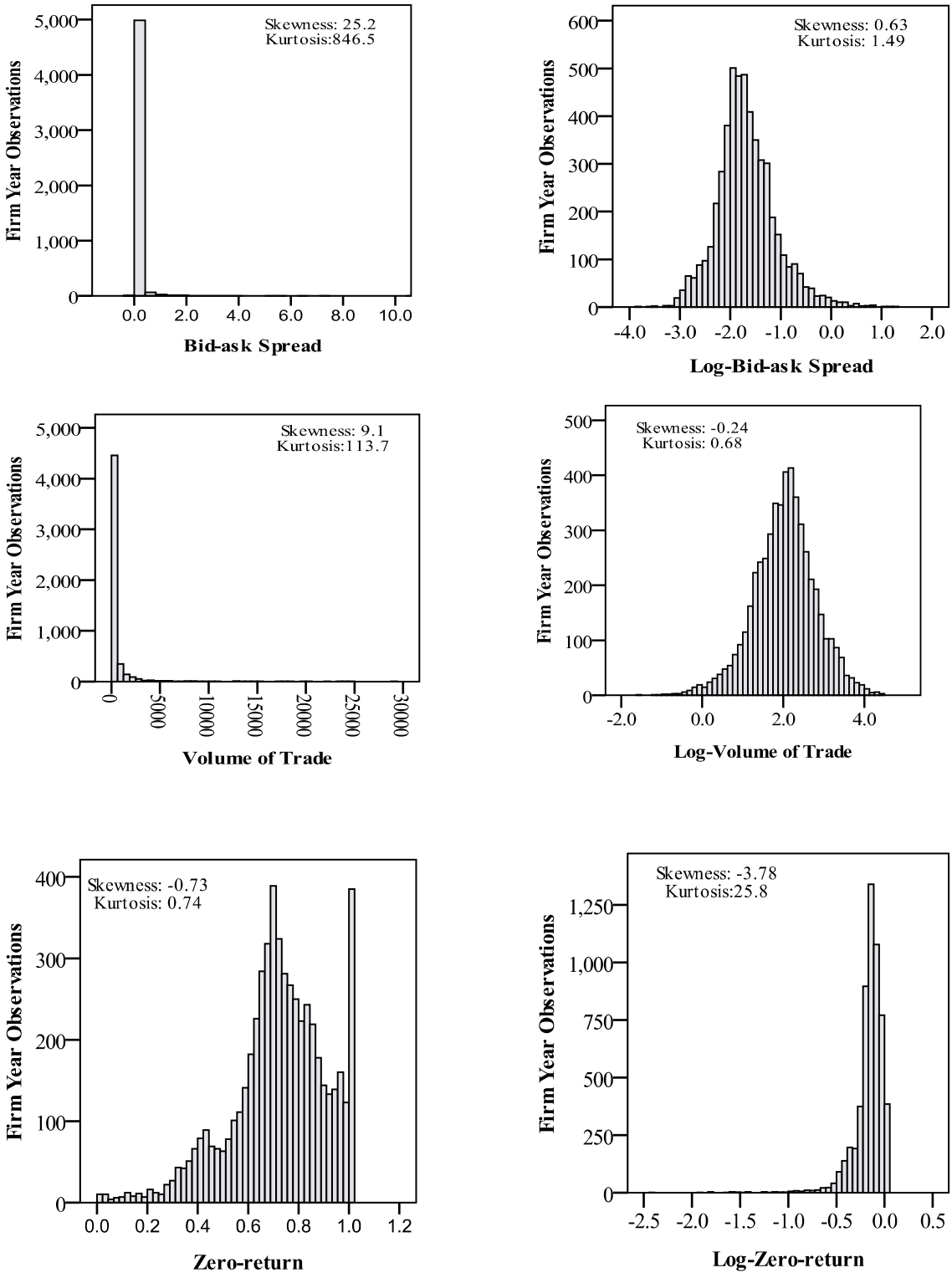
8.2.1 Determinants of leverage

Given the difficulty of adequately capturing the impact of liquidity, it is measured in three different ways. The first measure is bid-ask spread (spread) which is widely used by researchers, where the spread is defined as the ask price less bid price. Here, the natural logarithm of the annual average of daily spreads is used to capture the liquidity effect. It has been argued that spreads are a direct measure of transaction costs (Lesmond, Ogden &

[41] See Chapter 4 for the description of the data set.

Trzcinka 1999; Lipson & Mortal 2008). Though it is a widely used measure of liquidity, it is identified as relatively a poor proxy for the actual transaction costs faced by investors (Datar, Naik & Radcliffe 1998). Therefore, this study attempts to shed light on the relation between liquidity and capital structure using two additional proxies for liquidity. The study considers volume of trade (volume) which is often used as an empirical measure of liquidity and one would expect a negative correlation between transaction costs and volume. The natural log of average daily trading volume for the year is used to capture the liquidity effect. Finally, a more recent estimator is proposed by Lesmond, Ogden and Trzcinka (1999) to estimate liquidity and the impact of transaction costs regardless of time period, exchange, or firm. This is referred to as the zero-return measure. The proportion of zero return is defined as the number of days with zero returns in the year divided by the total trading days in the year. Figure 8.1 provides histograms of the three different proxies with and without log transformation below. While log transformation of spread and volume is warranted there seems to be little benefit gained from log transformations of the zero return measure as this increases the skewness and kurtosis (-3.78 and 25.8 respectively) considerably due to the existence of companies with few zero return days.

Figure 8.1: Distribution of Bid-ask spread, Volume of trade and Zero-return measure without and with log transformations



8.2.2 Summary statistics

Table 8.1 presents year wise summary statistics for the three liquidity measures for all filters[42]. Where spread is defined as the natural logarithm of the annual average of daily spread, volume is defined as the natural log of average daily trading volume for the year and zero return is defined as the number of days with zero returns in the year divided by the total trading days in the year. The sample is divided into small and large firms. A firm is considered to be a small firm if it falls below the median value of total assets and a firm is considered to be a large firm if it falls above the median value of assets. Small and large firms are included in the descriptive statistics to highlight variation in the results associated with firm size. Panels A, B and C of Table 8.1 contain year-by-year descriptive statistics for the Baker and Wurgler (2002) filtered data, the unfiltered data, and the four standard deviation filtered data respectively.

Panel A of Table 8.1 shows that bid-ask spread decreases over the years from an average of -1.59 in 2001 to -1.71 in 2005 for all firms. Similar patterns are evident using small firms and large firms. Further, average volume rises from an average of 1.92 in 2001 to 2.23 in 2005 for all firms. Small and large firms also show rises in volume over the period. The variation in spread and increasing volume are consistent with previous research (Frieder & Martell 2006; Lipson & Mortal 2008). The descriptive statistics for the zero-return measure show a more stable pattern over the years. For example, using all firms, the mean value of the zero-return measure in 2001 is 0.66 and it remains little changed over the years except for a slight increase in 2003 with a value of 0.67. Generally, small firms and large firms also show a steady pattern except for a slight decrease in 2005 with a value of 0.71 (from 0.74 in 2004) using small firms and slight increase in year 2003 with a value of 0.63 (from 0.61 in 2002) using large firms.

Panel B and C of Table 8.1 report the results for the unfiltered data and the four standard deviation filtered data respectively. The results show similar findings as to those obtained from the Baker and Wurgler (2002) filtered data results which shows decreasing spread, increasing volume and steady zero-return over the five year period.

[42] Other control variables descriptive statistics are not reported here as they are reported in chapters 5 and 6 (with year wise and full period).

Table 8.1: Year wise summary statistics for all filters (For the period, 2001-2005)

The sample covers the data set from the period, 2001 to 2005. Here, whole sample is further divided into two categories: small firms and large firms. Firms below the median value of total assets is considered as small firms and firms above the median value of total assets are considered as large firms. Summary statistics presented below with the three measures of liquidity that are; log of spread, log of volume of trade and zero-returns.

	All firms						**Small Firms, below median assets**						**Large Firms, above median assets**					
Year	Total	2001	2002	2003	2004	2005	Total	2001	2002	2003	2004	2005	Total	2001	2002	2003	2004	2005
Panel A: Baker and Wurgler filtered data																		
Firm year observations	2532	345	454	511	589	633	952	145	180	178	217	231	1580	200	273	333	372	402
Log Spread																		
Mean	-1.63	-1.59	-1.58	-1.59	-1.66	-1.71	-1.80	-1.74	-1.76	-1.76	-1.82	-1.87	-1.54	-1.48	-1.46	-1.49	-1.57	-1.61
SD	0.53	0.59	0.54	0.53	0.51	0.51	0.57	0.67	0.56	0.55	0.52	0.55	0.48	0.49	0.50	0.49	0.48	0.45
Minimum	-3.63	-3.63	-3.06	-3.17	-3.12	-3.24	-3.63	-3.63	-3.06	-3.17	-3.12	-3.24	-3.11	-2.86	-2.71	-2.63	-3.01	-3.11
Maximum	1.33	0.46	0.81	1.20	1.33	0.38	0.46	0.46	0.14	-0.08	-0.36	-0.18	1.33	0.05	0.81	1.20	1.33	0.38
Log Volume of Trade																		
Mean	2.10	1.92	2.02	2.03	2.19	2.23	1.97	1.75	1.86	1.91	2.08	2.15	2.18	2.05	2.12	2.10	2.25	2.28
SD	0.78	0.79	0.76	0.79	0.76	0.76	0.70	0.75	0.66	0.68	0.68	0.70	0.81	0.80	0.80	0.83	0.80	0.79
Minimum	-1.60	-0.46	-0.14	-1.60	-0.82	-0.14	-0.46	-0.46	-0.14	0.19	0.24	-0.14	-1.60	-0.09	0.01	-1.60	-0.82	-0.10
Maximum	4.39	4.27	4.39	4.37	4.29	4.31	4.12	3.53	3.46	3.88	4.12	3.93	4.39	4.27	4.39	4.37	4.29	4.31
Zero-Returns																		
Mean	0.66	0.66	0.66	0.67	0.66	0.66	0.73	0.74	0.74	0.75	0.74	0.71	0.62	0.60	0.61	0.63	0.62	0.63
SD	0.19	0.21	0.20	0.20	0.18	0.17	0.16	0.18	0.16	0.14	0.16	0.15	0.20	0.21	0.21	0.21	0.18	0.18
Minimum	0.00	0.00	0.00	0.02	0.04	0.02	0.02	0.03	0.11	0.28	0.08	0.02	0.00	0.00	0.00	0.02	0.04	0.02
Maximum	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00
Panel B: Unfiltered data																		
Firm year observations	3450	552	677	692	749	780	1522	236	305	324	329	328	1928	315	372	368	420	452
Log Spread																		
Mean	-1.67	-1.61	-1.57	-1.63	-1.74	-1.78	-1.81	-1.78	-1.68	-1.75	-1.89	-1.95	-1.56	-1.48	-1.48	-1.53	-1.61	-1.65
SD	0.59	0.63	0.61	0.59	0.55	0.54	0.65	0.71	0.69	0.65	0.59	0.58	0.50	0.54	0.52	0.50	0.49	0.46
Minimum	-3.79	-3.48	-3.08	-3.79	-3.17	-3.63	-3.79	-3.48	-3.08	-3.79	-3.17	-3.63	-3.12	-2.78	-2.80	-2.92	-3.12	-3.11
Maximum	1.33	0.81	1.20	1.33	0.87	0.55	0.87	0.76	0.86	0.58	0.87	0.55	1.33	0.81	1.20	1.33	0.71	0.38

Table 8.1: Year wise summary statistics for all filters (For the period, 2001-2005) (continued)

	All firms						Small Firms, below median assets						Large Firms, above median assets					
Year	Total	2001	2002	2003	2004	2005	Total	2001	2002	2003	2004	2005	Total	2001	2002	2003	2004	2005
Firm year observations	3450	552	677	692	749	780	1522	236	305	324	329	328	1928	315	372	368	420	452
Log Volume of Trade																		
Mean	2.03	1.86	1.90	1.94	2.18	2.21	1.92	1.77	1.74	1.79	2.10	2.13	2.13	1.94	2.04	2.07	2.24	2.27
SD	0.78	0.78	0.79	0.76	0.74	0.74	0.72	0.72	0.72	0.67	0.70	0.70	0.81	0.82	0.83	0.80	0.77	0.77
Minimum	-1.60	-0.88	-1.60	-0.82	-0.40	-1.11	-1.11	-0.88	-0.78	-0.54	-0.40	-1.11	-1.60	-0.16	-1.60	-0.82	-0.08	-0.10
Maximum	4.39	4.27	4.39	4.37	4.29	4.39	4.39	3.52	3.39	4.11	3.88	4.39	4.39	4.27	4.39	4.37	4.29	4.31
Zero-Returns																		
Mean	0.70	0.68	0.69	0.72	0.69	0.69	0.77	0.75	0.77	0.80	0.75	0.76	0.64	0.62	0.63	0.65	0.63	0.64
SD	0.18	0.20	0.19	0.19	0.17	0.17	0.14	0.14	0.14	0.13	0.14	0.13	0.20	0.22	0.21	0.20	0.18	0.18
Minimum	0.00	0.00	0.00	0.02	0.04	0.02	0.11	0.15	0.11	0.28	0.13	0.32	0.00	0.00	0.00	0.02	0.04	0.02
Maximum	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Panel C: Four Standard Deviation filtered data																		
Firm year observation	3434	578	666	702	760	729	1517	243	303	332	340	299	1917	335	363	370	419	430
Log Spread																		
Mean	-1.68	-1.65	-1.62	-1.64	-1.72	-1.76	-1.83	-1.83	-1.75	-1.77	-1.86	-1.93	-1.57	-1.52	-1.52	-1.53	-1.61	-1.65
SD	0.59	0.63	0.61	0.59	0.57	0.56	0.64	0.67	0.67	0.64	0.62	0.60	0.52	0.56	0.53	0.51	0.49	0.49
Minimum	-3.79	-3.63	-3.11	-3.79	-3.23	-3.24	-3.79	-3.48	-3.11	-3.79	-3.23	-3.24	-3.63	-3.63	-2.94	-2.92	-3.12	-3.11
Maximum	1.33	0.76	0.86	1.20	1.33	0.55	0.87	0.76	0.86	0.58	0.87	0.55	1.33	0.73	0.81	1.20	1.33	0.44
Log Volume of Trade																		
Mean	2.05	1.94	1.95	1.96	2.14	2.20	1.93	1.87	1.79	1.84	2.05	2.11	2.14	2.00	2.09	2.07	2.22	2.27
SD	0.78	0.80	0.78	0.77	0.76	0.77	0.72	0.72	0.72	0.67	0.72	0.73	0.82	0.85	0.81	0.83	0.78	0.79
Minimum	-1.60	-0.88	-0.78	-1.60	-0.82	-1.11	-1.11	-0.88	-0.78	-0.73	-0.40	-1.11	-1.60	-0.46	-0.14	-1.60	-0.82	-0.14
Maximum	4.39	4.35	4.39	4.37	4.29	4.39	4.39	3.90	4.11	3.88	3.98	4.39	4.39	4.35	4.39	4.37	4.29	4.31
Zero-Returns																		
Mean	0.70	0.69	0.70	0.72	0.69	0.69	0.77	0.75	0.77	0.79	0.76	0.76	0.64	0.65	0.65	0.65	0.64	0.64
SD	0.19	0.20	0.19	0.19	0.17	0.17	0.14	0.15	0.15	0.13	0.14	0.14	0.20	0.22	0.21	0.20	0.18	0.18
Minimum	0.00	0.00	0.00	0.02	0.04	0.02	0.06	0.15	0.11	0.28	0.13	0.06	0.00	0.00	0.00	0.02	0.04	0.02
Maximum	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

8.3 LIQUIDITY AND CAPITAL STRUCTURE

In this section, the relation between liquidity and leverage is captured through the use of interaction terms. Previous research finds that more liquid firms (those with lower trading costs) tend to have lower cost of equity (Frieder & Martell 2006; Lipson & Mortal 2008; Titman & Wessels 1988). Hence, it is expected that liquid firms employ a greater degree of equity financing and, therefore, to have a lower target leverage. Both pooled OLS and fixed effect models are used in the analysis that follows though only the fixed effect results are reported in this chapter.[43]

8.3.1 Determinants of leverage with Baker and Wurgler (2002) model

The three liquidity measures are included in the Baker and Wurgler (2002) equation (3.6) to test the relationship between leverage and other control variables with respect to liquidity.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g(EFWAMB)_t * liquidity + h\left(\frac{M}{B}\right)_{t-1} * liquidity + i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity$$
$$+ k\log(S)_{t-1} * liquidity + u_t$$

(8.1)

In equation (8.1), the dependent variable leverage is defined in two ways: book value of leverage that is defined as book debt to total assets and market value of leverage that is defined as book debt divided by total assets minus book equity plus market value of equity. The liquidity measures are log spread, log volume and zero return. Other control variables are defined in chapter 3. While the first line of the regression model provides estimates of the coefficients that apply to the control variables and the chosen liquidity measure, second line lists the interaction term coefficients (variable*liquidity

[43] Pooled OLS results are similar to fixed effect results and so are not reported separately.

measure). Panels A, B and C of Table 8.2 present results from analysis of the Baker and Wurgler (2002) filtered data, unfiltered data and the four standard deviation filtered data respectively.

In Panel A of Table 8.2 (Baker and Wurgler (2002) filtered data) it is apparent that, EFWAMB (timing/growth options measure) is not sensitive to liquidity and its impact on leverage is not significant. It is found that, the effect of market-to-book ratio is also not sensitive to liquidity (exceptions include in case of market leverage when volume is used as a proxy for liquidity, (t = 2.59)). The profitability (cash flow measure) results show that greater liquidity is associated with less sensitivity of leverage to cash flow[44]. It is also evident that leverage is decreasing in cash flow with higher levels of liquidity. This result is supported by the original Myers and Majluf (1984) model that suggests profitability plays a critical role in the capital structure decision but it is also sensitive to liquidity. Further, the sensitivity of leverage to asset tangibility (agency costs) is affected by liquidity in the market. Coefficient signs on other control variables are consistent with previous studies (Amihud & Mendelson 1986a; Baker & Wurgler 2002; Fama & French 2002; Grossman & Miller 1988; Myers & Majluf 1984; Titman & Wessels 1988). Finally, the larger the volume, and the narrower the spread, lower the leverage.

Unfiltered data results reported in Panel B of Table 8.2 suggest that the profitability/leverage relationship is not sensitive to liquidity. However, the asset tangibility effect for both leverage measure is sensitive to liquidity. This is consistent with the Baker and Wurgler (2002) filtered data results in Panel A. Further, EFWAMB and market-to-book are sensitive to liquidity especially in case of market leverage. Market-to-book is significantly negatively related market leverage which implies that more liquid firms are able to issue more equity and thus have less debt.

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[44] For example, consider the first derivative of leverage (book value) with respect to profitability (cash flow measure) which is:

$$\frac{d\left(D/A\right)}{d\left(EBITDA/A\right)} = -5.44\left(EBITDA/A\right) + 5.31\text{Volume}^{*}\left(EBITDA/A\right)$$

Table 8.2: Determinants of leverage and Liquidity Measures: All Filters (For the period, 2001-2005)

Fixed effects panel analysis of leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability and firm size for all filters is conducted on the model below:

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EFWAMB)_t * liquidity + h\left(\frac{M}{B}\right)_{t-1} * liquidity$$
$$+ i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + k\log(S)_{t-1} * liquidity + u_t$$

Here, The intercept, a, is not reported in the panels that follow. Leverage, $\left(\frac{D}{A}\right)_t$ is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. Market-to-book is defined in two ways: The (EFWAMB) which is the external finance weighted average market-to-book ratio and $\left(\frac{M}{B}\right)$, the market-to-book ratio which is defined as, total assets less book value of equity plus market value of equity over assets. Tangibility is measured as net property, plant and equipment/total assets. Profitability is earnings before interest, taxes and depreciation/total assets. Size is the natural logarithm of total revenue. The last variable reflects the liquidity measure coefficients where liquidity measures are defined in 3 ways: BAS is the natural logarithm of annual average of the daily bid-ask spread, VO is the natural logarithm of average daily trading volume for the year and Zero is the zero-return measure which is defined as the number of days with zero returns in the year divided by total trading days in the year. While the first line of the regression model provides estimates of the coefficients that apply to the control variables and the liquidity measure, the second line of coefficients refers to the interactions term coefficients (variable*liquidity). Robust t-statistics are in parenthesis.

Table 8.2: Determinants of leverage and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data, N= 2532													
Panel 1: Book Leverage													
Variables	0.010	(1.16)	-0.017	(-0.98)	-0.132	(-5.77)	-0.224	(-4.04)	0.079	(5.13)	0.109	(1.51)	0.58
BAS*Variable	0.006	(1.00)	-0.005	(-0.38)	-0.126	(-6.62)	-0.112	(-3.64)	-0.004	(-0.45)			
Variable	0.010	(1.05)	-0.007	(-0.56)	-0.054	(-2.73)	-0.332	(-5.44)	0.127	(10.09)	0.042	(0.96)	0.59
VO*Variable	-0.003	(-0.76)	0.000	(0.08)	0.055	(3.48)	0.138	(5.31)	-0.013	(-2.09)			
Variable	-0.010	(-0.93)	-0.012	(-0.48)	0.205	(6.79)	-0.008	(-0.05)	0.071	(4.76)	-0.216	(-1.54)	0.59
Zero*variable	0.018	(1.14)	0.005	(0.12)	-0.186	(-6.23)	-0.018	(-0.08)	0.035	(1.56)			
Panel 2: Market Leverage													
Variables	-0.004	(-0.30)	-0.097	(-5.14)	-0.138	(-3.38)	-0.337	(-5.65)	0.020	(1.31)	0.275	(3.47)	0.61
BAS*Variable	-0.001	(-0.06)	-0.015	(-1.17)	-0.131	(-3.85)	-0.142	(-3.83)	-0.024	(-2.69)			
Variable	0.001	(0.09)	-0.120	(-5.93)	-0.003	(-0.27)	-0.376	(-15.19)	0.082	(6.48)	-0.076	(-1.61)	0.62
VO*Variable	-0.001	(-0.36)	0.023	(2.59)	0.021	(2.05)	0.122	(9.17)	-0.004	(-0.62)			
Variable	-0.014	(-1.05)	-0.050	(-1.96)	0.149	(4.14)	-0.100	(-0.86)	0.028	(1.31)	-0.381	(-1.48)	0.59
Zero*variable	0.018	(0.91)	-0.043	(-1.12)	-0.125	(-3.34)	0.009	(0.06)	0.066	(1.97)			
Panel B: Unfiltered data, N = 3450													
Panel 1: Book Leverage													
Variables	-0.097	(-0.34)	-0.035	(-1.23)	-0.205	(-1.87)	0.044	(0.41)	-1.995	(-2.07)	7.746	(2.12)	0.39
BAS*Variable	-0.017	(-0.09)	-0.029	(-1.06)	-0.163	(-1.84)	0.005	(0.10)	-0.895	(-2.12)			
Variables	-0.738	(-3.63)	-0.138	(-1.59)	-0.376	(-2.22)	-0.018	(-0.39)	-2.655	(-2.45)	-9.496	(-2.76)	0.40
VO*Variable	0.268	(3.16)	0.070	(1.52)	0.256	(2.13)	0.021	(0.85)	1.060	(2.59)			
Variables	0.382	(1.34)	0.155	(1.58)	0.900	(1.41)	-0.559	(-0.76)	2.272	(1.62)	30.181	(1.57)	0.34
Zero*variable	-0.567	(-1.33)	-0.203	(-1.58)	-1.019	(-1.39)	0.532	(0.74)	-3.586	(-1.54)			

Table 8.2: Determinants of leverage and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel 2: Market Leverage													
Variables	-0.017	(-3.68)	-0.002	(-1.78)	-0.002	(-0.39)	0.001	(0.23)	0.030	(5.39)	0.214	(14.05)	0.58
BAS*Variable	-0.007	(-2.96)	-0.002	(-1.94)	-0.015	(-2.10)	-0.0005	(-0.21)	-0.025	(-11.50)			
Variable	-0.005	(-1.19)	-0.008	(-2.18)	-0.018	(-2.43)	-0.0005	(-0.14)	0.073	(10.90)	-0.096	(-4.87)	0.60
VO*Variable	-0.001	(-0.26)	0.004	(2.25)	0.023	(4.32)	0.001	(0.86)	0.002	(0.87)			
Variable	-0.024	(-4.06)	-0.010	(-1.72)	0.084	(3.34)	-0.002	(-0.10)	0.068	(7.50)	-0.004	(-0.06)	0.59
Zeros*variable	0.019	(2.33)	0.013	(1.66)	-0.079	(-2.55)	0.004	(0.22)	0.013	(1.23)			
Panel C: Four Standard Deviation filtered data, N = 3434													
Panel 1: Book Leverage													
Variables	0.061	(2.06)	0.020	(1.18)	-0.026	(-0.25)	0.044	(1.51)	0.011	(0.53)	0.366	(4.55)	0.41
BAS*Variable	0.014	(1.36)	0.030	(1.96)	-0.037	(-0.52)	0.082	(4.91)	-0.039	(-3.62)			
Variable	0.053	(2.05)	0.040	(2.53)	-0.059	(-0.67)	-0.017	(-0.22)	0.048	(2.04)	-0.205	(-2.49)	0.41
VO*Variable	-0.016	(-2.08)	-0.025	(-1.93)	0.058	(1.24)	0.0003	(0.01)	0.019	(1.80)			
Variable	-0.014	(-1.50)	-0.038	(-2.61)	0.038	(0.42)	-0.574	(-3.71)	0.146	(8.18)	0.405	(1.59)	0.39
Zeros*variable	0.025	(1.97)	0.060	(2.96)	0.080	(0.46)	0.606	(3.78)	-0.058	(-1.69)			
Panel 2: Market Leverage													
Variables	-0.009	(-1.65)	-0.017	(-3.17)	-0.080	(-1.85)	-0.008	(-1.01)	0.039	(10.81)	0.182	(12.13)	0.56
BAS*Variable	-0.004	(-1.26)	0.000	(0.02)	-0.103	(-3.70)	0.016	(3.24)	-0.017	(-5.72)			
Variable	0.013	(2.19)	-0.007	(-1.50)	-0.007	(-0.12)	-0.023	(-1.58)	0.090	(19.61)	-0.010	(-0.50)	0.58
VO*Variable	-0.007	(-2.20)	-0.004	(-1.20)	0.046	(1.76)	0.003	(0.42)	-0.007	(-2.82)			
Variable	-0.013	(-3.20)	-0.044	(-3.91)	0.170	(4.37)	-0.133	(-7.12)	0.060	(9.22)	-0.141	(-1.63)	0.55
Zeros*variable	0.016	(3.86)	0.037	(3.09)	-0.104	(-1.63)	0.129	(6.15)	0.025	(2.49)			

When a four standard deviation filtered data is used to estimate equation (8.1), the results of Panel C, Table 8.3 show that the sensitivity of leverage to EFWAMB and market-to-book is evident which is similar to unfiltered data result. Further, the sensitivity of market leverage to asset tangibility is affected by liquidity. This is consistent with the Baker and Wurgler (2002) filtered data and unfiltered data results though there is no interaction between liquidity and asset tangibility for book leverage. The relation between leverage and profitability is also sensitive to liquidity measures with the exception of volume. Other results are similar to those reported for the Baker and Wurgler (2002) filtered data and the unfiltered data, which show that market-to-book and profitability is negatively related to market leverage and firm size is negatively related to spread for both leverage.

As indicated in Table 8.2 bid-ask spread liquidity measure is positively related to leverage and the volume liquidity measure is negatively related to leverage in most of the estimated models. This findings suggest that heavily traded firms tend to have lower leverage, consistent with Myers and Majluf (1984). However, the zero-return measure of liquidity is not significantly related to leverage. Table 8.2 also suggests that, filter choice is important when examining the impact of liquidity on capital structure. The main effect reported in Table 8.2 implies that, the larger the volume, the narrower the spread and the lower the leverage. Interaction effects highlight the importance of liquidity for leverage as it affects leverage sensitivity to market timing, agency costs and information asymmetry.

8.3.2 Determinants of leverage with Hovakimian (2006) model

In this section, equation (8.1) is re-estimated following Hovakimian (2006) definitions of leverage and EFWAMB.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g(EFWAMB)^*_t * liquidity + h\left(\frac{M}{B}\right)_{t-1} * liquidity + i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity$$
$$+ k\log(S)_{t-1} * liquidity + u_t \qquad (8.2)$$

In equation (8.2), the dependent variable, leverage is defined as long-term debt + short-term debt over total assets. EFWAMB* denoted with star sign to show a difference in the calculation of EFWAMB[45]. Other independent variables include firm characteristics that are discussed in chapter 3. Similar to previous equation, the first line of the regression model provides estimates of the coefficients that apply to the control variables and the chosen liquidity measure, the second line of the coefficient refers to the interaction term coefficients (variable*liquidity measure). Panels A, B and C of Table 8.3 present result of this analysis for the Baker and Wurgler (2002) filtered data, unfiltered data and a four standard deviation filtered data respectively.

The interaction results using the Baker and Wurgler (2002) filtered data in Panel A of Table 8.3 show that the sensitivity of leverage to EFWAMB* is affected by the zero return liquidity measure but it is not sensitive to the other two measures of liquidity. Leverage is sensitive to market-to-book only when the volume liquidity measure is included in the model. Leverage is sensitive to asset tangibility with all of the liquidity measures. This is consistent with previous findings (Panel A, Table 8.2). Furthermore, leverage is sensitive to profitability while using zero-return measure. Similar to Panel A of Table 8.2, the bid-ask spread is positively related to leverage and volume is negatively related to leverage though there is little economic impact. Thus the wider the spread, lower the volume the lower the leverage. Overall, similar findings are noted here as to those of Table 8.2 Panel A, though there is some variation in the parameter signs and significance.

[45] Refer to chapter 6 for the definition of EFWAMB*.

Table 8.3: Determinants of book leverage and Liquidity Measures: All Filters (For the period, 2001-2005)

Fixed effects panel analysis of leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability and firm size using all filters is conducted on the model below:

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EFWAMB)^*_t * liquidity + h\left(\frac{M}{B}\right)_{t-1} * liquidity$$
$$+ i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + k\log(S)_{t-1} * liquidity + u_t$$

Here, The intercept, a, is not reported in the panels that follow. Leverage is defined as, long-term debt + short-term debt over total assets. Market-to-book is defined in two ways: The (EFWAMB*) which is the external finance weighted average market-to-book ratio and $\left(\frac{M}{B}\right)$, the market-to-book ratio which is defined as, total assets less book value of equity plus market value of equity over total assets. Tangibility is measured as the net property, plant and equipment/total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And size is the natural logarithm of total revenue. The last variable reflects the liquidity measure coefficients where liquidity measures are defined in 3 ways: BAS is the natural logarithm of annual average of the daily bid-ask spread, VO is the natural logarithm of average daily trading volume for the year and Zero is the zero-return measure which is defined as the number of days with zero returns in the year divided by total trading days in the year. While the first line of the regression model provides estimates of the coefficients that apply to the control variables and the liquidity measure, the second line of coefficients refers to the interactions term coefficients (variable*liquidity). Robust t-statistics are in parenthesis.

Table 8.3: Determinants of book leverage and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data, N = 2,532													
Variables	0.005	(0.61)	-0.020	(-1.41)	-0.130	(-6.79)	-0.109	(-1.51)	0.046	(5.28)	0.038	(1.07)	0.50
BAS*Variable	0.005	(1.13)	-0.006	(-0.72)	-0.140	(-13.65)	-0.035	(-0.74)	0.004	(0.80)			
Variable	0.002	(0.33)	-0.025	(-4.55)	-0.074	(-6.85)	-0.074	(-0.92)	0.038	(4.55)	-0.050	(-1.81)	0.50
VO*Variable	-0.002	(-0.71)	0.008	(3.33)	0.081	(7.02)	0.015	(0.37)	0.002	(0.54)			
Variable	-0.018	(-4.98)	0.013	(0.67)	0.463	(15.71)	-0.398	(-4.13)	0.053	(3.43)	0.255	(1.26)	0.53
Zeros*variable	0.022	(3.16)	-0.032	(-1.17)	-0.448	(-13.92)	0.497	(4.35)	-0.019	(-0.77)			
Panel B : Unfiltered data, N = 3,450													
Variables	0.052	(1.76)	0.022	(0.99)	-0.057	(-1.33)	0.054	(1.08)	-0.262	(-1.29)	1.080	(1.55)	0.50
BAS*Variable	0.023	(1.81)	0.024	(1.09)	-0.058	(-1.51)	0.032	(1.15)	-0.121	(-1.44)			
Variable	0.023	(1.35)	-0.039	(-0.90)	-0.143	(-1.46)	0.007	(0.45)	-0.513	(-1.38)	-1.993	(-1.53)	0.50
VO*Variable	-0.011	(-1.81)	0.018	(0.85)	0.108	(1.57)	0.000	(0.03)	0.227	(1.52)			
Variable	0.002	(0.14)	0.034	(1.60)	0.155	(3.16)	-0.123	(-1.86)	0.065	(3.21)	0.443	(1.97)	0.32
Zeros*variable	0.004	(0.18)	-0.045	(-1.60)	-0.161	(-2.83)	0.117	(1.74)	-0.025	(-0.80)			
Panel C: Four Standard Deviation filtered data, N = 3,434													
Variables	0.087	(3.98)	-0.013	(-0.85)	0.103	(1.26)	0.023	(0.96)	-0.004	(-0.35)	0.121	(2.93)	0.40
BAS*Variable	0.042	(3.85)	-0.002	(-0.22)	-0.005	(-0.08)	0.040	(3.58)	-0.018	(-2.46)			
Variable	0.073	(3.21)	-0.014	(-0.74)	0.102	(1.25)	-0.018	(-0.31)	-0.017	(-0.88)	-0.164	(-2.80)	0.39
VO*Variable	-0.030	(-2.87)	0.004	(0.40)	0.014	(0.29)	0.008	(0.30)	0.024	(2.73)			
Variable	0.015	(1.37)	-0.015	(-1.85)	0.301	(3.53)	-0.348	(-2.76)	0.056	(4.01)	0.210	(2.21)	0.37
Zeros*variable	0.001	(0.04)	0.008	(0.72)	-0.229	(-1.76)	0.371	(2.77)	-0.013	(-0.51)			

The interaction results for unfiltered data in Panel B of Table 8.3 show that the sensitivity of leverage to EFWAMB* is affected by liquidity (except for the zero-return measure). Leverage is sensitive to asset tangibility and profitability when zero-return measure is used. However, the liquidity interaction results for other control variables do not show a significant effect on leverage. The unfiltered data results show that spread is positively related to leverage and volume is negatively related to leverage, though with little economic impact. This is consistent with Table 8.2 Panel B findings.

When a four standard deviation filtered data is used, it is found that all the liquidity measures play an important role in explaining capital structure. The results show that leverage is sensitive to EFWAMB* with respect to liquidity[46]. It is also found that profitability effect is sensitive to liquidity (except for volume). This is consistent with the Table 8.2 Panel C result. Further, bid-ask spread and zero-return measures are significantly positively related to leverage and volume is significantly negatively related to leverage. Hence, the main effect noted from Panel C of Table 8.3 is that, more liquid firms (lower cost of trading) will tend to have lower leverage consistent with the results in Table 8.3.

In summary, the results in Table 8.4 is similar to those in Table 8.3 though parameter signs vary somewhat, suggesting that more liquid firms tend to have lower leverage. This provides further supports for the argument that liquidity has a significant impact on Australian capital structure.

8.3.2.1 Cumulative net equity issues, net debt issues and liquidity

Appendix A-8.1 includes analysis of determinants of leverage (equation 3.6) using cumulative net equity (EqIs) and cumulative net debt issues (DbIs). The three liquidity measures are also included in this model (following Hovakimian 2006) to examine the effect of liquidity with these additional explanatory variables.

[46] Specifically the t-statistics for the coefficients of the interactions using bid-ask spread and volume for EFWAMB* are 3.85 and -2.87 respectively.

While some of the regression results are consistent with original Hovakimian (2006) and Baker and Wurgler (2002) results reported in earlier chapters, there are some inconsistencies once liquidity measures are introduced. It is found that though the market liquidity affect on leverage operates through asset tangibility (agency costs) and profitability (cash flow) but the impact of growth options/market timing (EFWAMB and market-to-book) varies considerably. However, all three filtered results (Panel A, B and C of appendix A-8.1) document that bid-ask spread and zero-return measures are positively correlated with leverage and volume is negatively correlated with leverage, which is consistent with previous findings (Tables 8.2, 8.3). Overall, appendix A-8.1 highlights the variation in the liquidity effects according to filter choice.

8.3.2.2 Changes in book leverage and liquidity

In this section, following the Hovakimian (2006) model, annual change in book leverage is regressed on firm characteristics (included in previous regressions) and liquidity measures along with interaction effects.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g\left(\frac{LT+ST}{A}\right)_{t-1} + h(EFWAMB)^*_t * liquidity + i\left(\frac{M}{B}\right)_{t-1} * liquidity + j\left(\frac{PPE}{A}\right)_{t-1} * liquidity$$
$$+ k\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + l\log(S)_{t-1} * liquidity + m\left(\frac{LT+ST}{A}\right)_{t-1} * liquidity + u_t$$

(8.3)

Here in (8.3), the dependent variable change in leverage is defined as leverage at time t minus leverage at time t-1. Lagged leverage is included in the model to be consistent with previous research. Results from analysis of changes in leverage for all filters are reported in Table 8.4.

The Baker and Wurgler (2002) filtered data results reported in Panel A, Table 8.4, show that the larger the volume, the narrower the spread and the less sensitive is leverage to asset tangibility (agency costs). This result is consistent with previous findings. The

sensitivity of leverage to profitability is not significantly affected by liquidity except for zero-return measure. The sensitivity of market-to-book is affected by liquidity only when the volume is used to capture the liquidity effects. However, the sensitivity of leverage to EFWAMB* is not affected by liquidity. Further, the interaction result shows that spread is positively related to lagged leverage (t = 1.82) which suggest that the wider the spread, the less sensitive is current leverage to leverage in the previous year. The interaction for volume is negatively related to lagged leverage (t = -2.37). These results suggest that more liquid the firms are, quicker to return toward their long run leverage level.

Unfiltered data results in Panel B, Table 8.4 show some interaction effects for market-to-book and lagged leverage. The lagged leverage result is similar as to that of reported for the Baker and Wurgler (2002) filtered data and suggest that the tendency for firms leverage to revert to a long run level is sensitive to liquidity. It suggest that the greater the liquidity in firms shares, the more rapid the return to some long run capital structure.

The four standard deviation filtered data (Panel C, Table 8.4) shows similar results as to those previously recorded. It is found that liquidity has a significant impact on the EFWAMB* relationship with leverage. A profitability (cash flow) interaction effect with liquidity is also evident (t = 2.85 for spread and t = 2.56 for zero return) which suggests, greater liquidity is associated with less sensitivity of leverage to cash flow. Panel C of Table 8.4 also exhibits similar results for lagged leverage which suggests that heavily traded firms are able to change their leverage more quickly than less traded firms.

A key interaction result obtained for two measures of liquidity (bid-ask spread and volume) from Table 8.4 for lagged leverage is the tendency to revert towards some long run leverage value which suggest, greater liquidity results in a more of rapid response to leverage shocks.

Table 8.4: Determinants of changes in book leverage and Liquidity Measures: All Filters (For the period, 2001-2005)

Fixed effects panel analysis of leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using all filters is conducted on the model below:

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + h(EFWAMB)^*_t * liquidity$$
$$+ i\left(\frac{M}{B}\right)_{t-1} * liquidity + j\left(\frac{PPE}{A}\right)_{t-1} * liquidity + k\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + l\log(S)_{t-1} * liquidity + m\left(\frac{LT+ST}{A}\right)_{t-1} * liquidity + u_t$$

Here, The intercept, a, is not reported in the panels that follow. Dependent variable change in leverage is defined as leverage at time t minus leverage at time t-1. Market-to-book is defined in two ways: EFWAMB is the external finance weighted average market-to-book ratio. And the market-to-book ratio is defined as, total assets less book value of equity plus market value of equity over total assets. Tangibility is measured as the net property, plant and equipment/total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And size is the natural logarithm of total revenue. The last variable reflects the liquidity measure coefficients where liquidity measures are defined in 3 ways: BAS is the natural logarithm of annual average of daily spread, VO is the natural logarithm of average daily trading volume for the year and Zero is the zero-return measure which is defined as the number of days with zero returns in the year divided by total trading days in the year. Robust t-statistics are in parenthesis.

Table 8.4: Determinants of changes in book leverage and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel A: Baker and Wurgler filtered data, N = 2,532															
Variables	-0.001	(-0.17)	-0.011	(-1.28)	-0.055	(-3.57)	0.018	(0.49)	0.002	(0.23)	-0.200	(-4.03)	0.065	(1.47)	0.49
BAS*Variable	0.001	(0.41)	-0.006	(-1.15)	-0.058	(-4.25)	0.023	(1.18)	-0.006	(-1.16)	0.083	(1.82)			
Variable	-0.002	(-0.35)	-0.012	(-4.13)	-0.043	(-3.02)	-0.036	(-0.65)	-0.010	(-1.02)	0.076	(0.66)	-0.071	(-2.25)	0.50
VO*Variable	-0.001	(-0.33)	0.005	(5.31)	0.039	(3.38)	0.008	(0.28)	0.011	(2.11)	-0.185	(-2.37)			
Variable	-0.007	(-1.86)	0.003	(0.23)	0.183	(5.56)	-0.207	(-3.58)	0.021	(2.16)	-0.443	(-2.48)	0.082	(0.51)	0.49
Zero*variable	0.005	(0.78)	-0.004	(-0.26)	-0.175	(-5.73)	0.253	(3.34)	-0.011	(-0.76)	0.135	(0.86)			
Panel B: Unfiltered data, N = 3,450															
Variables	-0.019	(-0.73)	0.028	(0.66)	-0.064	(-1.52)	0.039	(0.57)	-0.275	(-1.28)	-0.500	(-1.13)	1.160	(1.49)	0.80
BAS*Variable	-0.002	(-0.28)	0.024	(0.66)	-0.059	(-1.62)	0.026	(0.64)	-0.129	(-1.48)	0.249	(0.92)			
Variable	-0.067	(-1.3)	-0.087	(-2.05)	-0.149	(-1.59)	-0.004	(-0.26)	-0.589	(-1.49)	1.620	(2.09)	-2.128	(-1.58)	0.80
VO*Variable	0.014	(1.24)	0.046	(2.06)	0.098	(1.60)	0.010	(1.13)	0.260	(1.63)	-1.055	(-3.51)			
Variable	0.011	(0.75)	0.052	(1.94)	0.070	(1.39)	0.206	(1.36)	0.001	(0.05)	-0.174	(-0.54)	0.223	(1.23)	0.59
Zero*variable	-0.016	(-0.72)	-0.067	(-1.93)	-0.068	(-1.18)	-0.216	(-1.45)	0.025	(0.87)	-0.543	(-1.35)			
Panel C: Four Standard Deviation filtered data, N = 3,434															
Variables	0.031	(2.55)	-0.027	(-1.94)	-0.056	(-0.95)	0.029	(2.45)	-0.008	(-1.06)	-0.072	(-0.26)	0.124	(4.08)	0.56
BAS*Variable	0.016	(2.91)	-0.011	(-1.35)	-0.055	(-1.14)	0.029	(2.85)	-0.017	(-2.83)	0.387	(2.80)			
Variable	0.025	(2.85)	-0.027	(-1.65)	-0.024	(-0.55)	-0.023	(-0.70)	-0.043	(-3.78)	0.226	(0.86)	-0.194	(-6.97)	0.61
VO*Variable	-0.011	(-3.12)	0.010	(1.37)	0.036	(1.19)	0.025	(1.47)	0.032	(6.48)	-0.460	(-4.39)			
Variable	0.001	(0.13)	-0.015	(-2.36)	0.158	(2.06)	-0.283	(-2.42)	0.032	(4.33)	-0.568	(-3.63)	0101	(1.41)	0.54
Zero*variable	0.006	(0.55)	0.011	(1.14)	-0.118	(-1.01)	0.337	(2.56)	-0.009	(-0.95)	0.028	(0.12)			

8.3.2.3 Future EFWAMB, liquidity and capital structure

Here, the Hovakimian (2006) model (3.11) with future external finance weighted average market-to- book (FEFWAMB) is replicated including three liquidity measures and interaction terms. Results of this analysis are reported in Table 8.5.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1}$$
$$+ g(FFWAMB) * liquidity + h\left(\frac{M}{B}\right)_{t-1} * liquidity + i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity$$
$$+ k\log(S)_{t-1} * liquidity + u_t \tag{8.4}$$

Table 8.5 provides findings similar to those of previously reported analyses. Both Baker and Wurgler (2002) filtered data (Panel A) and unfiltered data (Panel B) analyses show that liquidity interaction terms are not significant (except for zero-return measure in case of unfiltered data) though the parameter signs remain same. The interaction terms for asset tangibility are similar to previous results and the interaction terms for profitability and FEFWAMB are also significant when zero return measure is used. There is no sensitivity found for market-to-book with respect to leverage using these two filters. However, when a four standard deviation filtered data is used (Panel C), the sensitivity of market-to-book on leverage is explained by liquidity (using spread and volume). And FEFWMB is affected by liquidity when volume is used. Finally, Panel C of Table 8.5 shows that spread is significantly positively and volume is negatively related to leverage as expected and consistent with previous findings.

Overall, the results of Table 8.5 indicates that when filter choice is changed the liquidity plays more significant role which may suggest that there are some important small firm effects in the analysis.

Table 8.5: Future EFWAMB and Liquidity Measures: All Filters (For the period, 2001-2005)

Fixed effects panel analysis of leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability and firm size for all filters is conducted on the model below:

$$\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(FFWAMB)_t * liquidity$$
$$+ h\left(\frac{M}{B}\right)_{t-1} * liquidity + i\left(\frac{PPE}{A}\right)_{t-1} * liquidity + j\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + k\log(S)_{t-1} * liquidity + u_t$$

The FEFWAMB is external finance weighted average of future market-to-book ratio. Other control variables are defined in Table 8.5. Robust t-statistics are in parenthesis.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data, N = 2,532													
Variables	0.008	(0.49)	-0.013	(-0.96)	-0.106	(-3.08)	-0.052	(-0.79)	0.049	(7.10)	0.012	(0.34)	0.49
BAS*Variable	0.012	(1.10)	-0.003	(-0.32)	-0.119	(-5.23)	-0.009	(-0.21)	0.006	(2.01)			
Variable	0.001	(0.02)	-0.016	(-2.65)	-0.075	(-4.76)	-0.033	(-0.34)	0.040	(5.79)	-0.031	(1.16)	0.49
VO*Variable	-0.006	(-0.61)	0.004	(1.51)	0.080	(5.10)	0.002	(0.04)	0.000	(0.13)			
Variable	0.034	(1.81)	0.006	(0.41)	0.456	(19.11)	-0.470	(-5.58)	0.062	(2.29)	0.428	(1.40)	0.53
Zero*variable	-0.083	(-3.18)	-0.021	(-0.97)	-0.441	(-15.48)	0.625	(5.79)	-0.036	(-0.88)			
Panel B: Unfiltered data, N = 3,450													
Variables	0.093	(1.21)	0.051	(1.43)	-0.046	(-1.05)	0.206	(0.98)	-0.355	(-1.31)	1.347	(1.55)	0.50
BAS*Variable	0.109	(1.31)	0.047	(1.42)	-0.042	(-1.09)	0.123	(1.05)	-0.153	(-1.43)			
Variable	0.030	(0.71)	-0.035	(-0.61)	-0.150	(-1.39)	-0.023	(-0.45)	-0.670	(-1.36)	-2.587	(1.48)	0.50
VO*Variable	-0.049	(-1.55)	0.016	(0.58)	0.110	(1.48)	0.024	(0.57)	0.294	(1.48)			
Variable	-0.010	(-2.2)	0.013	(1.55)	0.125	(2.24)	-0.480	(-3.76)	0.092	(4.40)	0.569	(1.91)	0.32
Zero*variable	0.011	(1.85)	-0.017	(-1.54)	-0.129	(-2.01)	0.515	(3.67)	-0.053	(-1.47)			

Table 8.5: Future EFWAMB and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel C: Four Standard Deviation filtered data, N = 3,434													
Variables	-0.001	(-0.03)	0.041	(3.66)	0.019	(0.18)	0.028	(1.67)	-0.011	(-0.87)	0.244	(4.39)	0.36
BAS*Variable	0.002	(0.17)	0.026	(3.86)	-0.055	(-0.69)	0.047	(4.62)	-0.022	(-2.96)			
Variable	0.047	(2.05)	0.041	(4.97)	0.019	(0.19)	0.002	(0.04)	-0.013	(-1.02)	-0.198	(-5.19)	0.36
VO*Variable	-0.023	(-2.51)	-0.020	(-4.55)	0.051	(0.91)	-0.007	(-0.27)	0.024	(4.83)			
Variable	0.019	(0.71)	-0.016	(-0.87)	0.309	(4.15)	-0.487	(-3.09)	0.067	(3.96)	0.244	(1.47)	0.36
Zero*variable	-0.039	(-1.08)	0.021	(0.85)	-0.250	(-1.85)	0.517	(3.08)	-0.020	(-0.72)			

Table 8.6 replicates the change in leverage regression (8.3) using FEFWAMB instead of EFWAMB. The model that is used here is follows:

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1}$$
$$+ h(FFWAMB)_t * liquidity + i\left(\frac{M}{B}\right)_{t-1} * liquidity + j\left(\frac{PPE}{A}\right)_{t-1} * liquidity + k\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity$$
$$+ l\log(S)_{t-1} * liquidity + m\left(\frac{LT+ST}{A}\right)_{t-1} * liquidity + u_t \qquad (8.5)$$

It appears from the analysis of Table 8.6 that there are some variations in the results especially when a four standard deviation filtered data is used. Both Baker and Wurgler (2002) filtered and unfiltered data (Panels A and B of Table 8.6 respectively) result show similar interaction effects as to those of Panel A and Panel B of Table 8.5 though the magnitude of parameters vary somewhat. From Panel A, it is found that the sensitivity of leverage to asset tangibility and profitability is significantly affected by liquidity only when zero-return measure is used. It also shows that market-to-book is sensitive to liquidity with respect to leverage (exception include for zero-return measure). However, lagged leverage seems to be not affected by liquidity. Panel B of Table 8.6 shows some sensitivity of leverage in case of FEFWMAB, market-to-book and lagged leverage.

However, when a four standard deviation filtered data is used (Panel C, Table 8.6), it is found that the sensitivity of leverage to FEFWAMB is significantly affected by liquidity (all three measures). This is not consistent with Baker and Wurgler (2002) filtered data result. The sensitivity of profitability is also evident though asset tangibility is not affected by liquidity. In general, the lagged leverage result is similar to those previously reported (except unfiltered result show insignificant interaction effect of spread). Hence, the tendency for firm leverage to revert to a long run level is sensitive to liquidity.

Table 8.6: Changes in leverage with Future EFWAMB and Liquidity Measures: All Filters (For the period, 2001-2005)

Fixed effects panel analysis of changes in leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability and firm size for all filters is conducted on the model below:

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + h(FFWAMB)_t * liquidity$$
$$+ i\left(\frac{M}{B}\right)_{t-1} * liquidity + j\left(\frac{PPE}{A}\right)_{t-1} * liquidity + k\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + l\log(S)_{t-1} * liquidity + m\left(\frac{LT+ST}{A}\right)_{t-1} * liquidity + u_t$$

The FEFWAMB is external finance weighted average of future market-to-book ratio. Refer to the Table 8.5 for variable definitions.
Robust t-statistics are in parenthesis.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel A: Baker and Wurgler filtered data, N = 2,532															
Variables	0.005	(0.25)	-0.007	(-1.70)	0.004	(0.13)	0.027	(0.74)	-0.004	(-0.41)	-0.143	(-2.15)	0.043	(0.98)	0.40
BAS*Variable	0.003	(0.27)	-0.004	(-1.68)	-0.006	(-0.25)	0.025	(1.27)	-0.004	(-0.67)	0.019	(0.56)			
Variable	0.006	(0.38)	-0.010	(-2.83)	-0.002	(-0.15)	-0.064	(-1.25)	0.003	(0.28)	-0.122	(-1.32)	-0.011	(-0.27)	0.40
VO*Variable	-0.004	(-0.63)	0.004	(2.25)	0.010	(0.88)	0.024	(0.90)	0.000	(0.07)	-0.026	(-0.66)			
Variable	0.012	(0.82)	0.005	(0.85)	0.133	(13.1)	-0.201	(-3.39)	0.018	(1.10)	-0.158	(-2.38)	0.229	(1.21)	0.40
Zero*variable	-0.024	(-1.20)	-0.006	(-0.72)	-0.128	(-15.04)	0.258	(3.24)	-0.023	(-0.97)	-0.047	(-0.48)			
Panel B: Unfiltered data, N = 3,450															
Variables	0.064	(1.11)	0.148	(1.50)	-0.044	(-1.4)	0.105	(0.97)	-0.331	(-1.25)	-0.803	(-0.90)	0.884	(1.24)	0.50
BAS*Variable	0.079	(1.24)	0.134	(1.50)	-0.025	(-1.22)	0.058	(0.97)	-0.093	(-1.21)	-0.747	(-0.82)			
Variable	0.031	(0.84)	-0.106	(-1.87)	-0.107	(-1.79)	-0.156	(-1.72)	-0.687	(-1.39)	0.980	(2.40)	-2.408	(-1.43)	0.50
VO*Variable	-0.049	(-1.82)	0.053	(1.89)	0.065	(1.9)	0.131	(1.79)	0.281	(1.46)	-0.504	(-3.86)			
Variable	-0.017	(-2.11)	0.060	(5.58)	0.072	(1.78)	-0.126	(-0.65)	0.035	(5.22)	-0.441	(-1.07)	0.455	(5.28)	0.58
Zero*variable	0.022	(2.48)	-0.078	(-5.71)	-0.074	(-1.56)	0.200	(0.91)	-0.028	(-2.02)	0.005	(0.01)			

Table 8.6: Changes in leverage with Future EFWAMB and Liquidity Measures: All Filters (For the period, 2001-2005) (continued)

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		Liquidity		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel C: Four Standard Deviation filtered data, N = 3,434															
Variables	0.033	(2.02)	-0.025	(-2.00)	-0.113	(-1.56)	0.027	(3.54)	-0.011	(-1.16)	0.184	(0.59)	0.148	(8.77)	0.54
BAS*Variable	0.018	(2.16)	-0.011	(-1.35)	-0.075	(-1.14)	0.021	(1.60)	-0.017	(-3.05)	0.519	(3.50)			
Variable	0.073	(3.58)	-0.018	(-1.33)	-0.052	(-0.93)	0.002	(0.06)	-0.036	(-4.46)	0.403	(1.46)	-0.192	(-10.04)	0.56
VO*Variable	-0.034	(-3.89)	0.007	(1.05)	0.041	(1.00)	0.004	(0.20)	0.032	(8.71)	-0.541	(-5.35)			
Variable	0.019	(1.73)	-0.020	(-4.16)	0.158	(2.61)	-0.220	(-2.10)	0.008	(0.83)	-0.525	(-2.42)	-0.097	(-1.06)	0.47
Zero*variable	-0.029	(-1.87)	0.021	(2.82)	-0.130	(-1.22)	0.252	(2.17)	0.016	(1.66)	0.099	(0.24)			

8.3.3 Discussion

Previous result following Baker and Wurgler (2002) and Hovakimian (2006) analysis including the interaction terms (variable*liquidity) show that once again filter choice plays an important role once liquidity measures are introduced. Generally, lack of interaction effect for EFWAMB and market-to-book is evident for Baker and Wurgler (2002) filtered data results (Tables 8.2, 8.3). One interpretation is that the Baker and Wurgler (2002) filtered data focuses on large firms and their leverage is not as sensitive to market conditions for smaller firms. However, the unfiltered and a four standard deviation filtered data results (Panels B and C respectively) of Tables 8.2 and 8.3 identifies liquidity as having a significant effect on EFWAMB and market-to-book with respect to leverage. These findings could result in advance of small firms that are more sensitive to liquidity, relative to large firms. Further, Tables 8.2 and 8.3 generally show that size is negatively related to spread and zero-return measures and positively related to volume (Frieder & Martell 2006). Finally, the main effect for liquidity, for the Baker and Wurgler (2002) filtered data results (Tables 8.2 to 8.6) is that higher volume and narrower spreads (higher the liquidity) are correlated with lower leverage.

Baker and Wurgler (2002) and Hovakimian (2006) find strong results for US firms but perhaps these results are not so strong for Australian firms. Filter choice suggest that there are some important small firm effects in Australian data (Tables 8.5, 8.6 and 8.7 using unfiltered and a four standard deviation filtered data). The interaction results for lagged leverage suggest that, generally, liquidity affects the ability of firms to move to their long run leverage objective. These results suggest that the more liquid the firm, the quicker the response to leverage shocks.

8.4 CONCLUSION

This study explores the link between market liquidity and Australian capital structure decisions by introducing liquidity interaction terms as well as a liquidity main effect within the Baker and Wurgler (2002) and Hovakimian (2006) framework. Liquidity affects firm value (Amihud & Mendelson 1986a) and plays a role in determining firm optimal capital structure. There are relatively few studies that examine how market liquidity affects corporate decisions and this study highlights this role. There is evidence that liquidity has a significant impact on Australian firm capital structure.

Liquidity interaction terms highlight the variation in capital structure determinants across different data filters and alternate models. Thus, one important contribution of this study is that it provides evidence that sample choice plays an important role in modelling firm corporate capital structure.

More generally, there is evidence that greater liquidity is associated with less sensitivity of leverage to cash flow. There is also evidence that more liquid firms have lower leverage and that current leverage is more sensitive to leverage shocks for more liquid firms because they are able to change their leverage more quickly. The tendency to revert towards a long run leverage value is also affected by liquidity of the firm's equity.

CHAPTER 9

CONCLUSION

9.1 INTRODUCTION

As argued in Chapter 1, the determinants of capital structure have become a question of increasing empirical importance. Changes in capital structure choice affect all firms, and therefore, managing external finance is a key concern in the area of corporate finance. Although theories have been developed to explain the determinants of capital structure, the issue of capital structure choice still remains a puzzle. This thesis provides further insight into this choice from an Australian perspective though there is little to contribute in terms of solving the puzzle.

9.2 SUMMARY OF THE THESIS

The issue that forms the central focus of the investigation addressed in this thesis is the capital structure choice of Australian firms with an emphasis on the impact of market timing and liquidity (transaction costs). The analysis addresses this central issue in four unique settings, which form the focus of each of the four empirical chapters. Underlying each of the chapters is a common thread of the relationship between capital structure and its determinants. Briefly, the focus of each chapter hinges on the following key research questions: (i) does market timing have an impact on Australian capital structure? (Chapter 5); (ii) does past market-to-book ratio contain information about growth opportunities for Australian firms? (Chapter 6); (iii) is there a significant difference between Australian mining and non-mining firm determinants of the capital structure decision? (Chapter 7); and (iv) does liquidity affect the Australian capital structure choice? (Chapter 8). These analyses are all conducted within the Baker and Wurgler (2002) and Hovakimian (2006) models using both pooled OLS and fixed effect panel data analysis.

Chapter 2 introduces this area of empirical research with a survey of the existing literature. It is noted from this survey that there is limited research into

Australian capital structure decisions. Previous literature has emerged mostly for the US. The literature survey begins with detailed discussion of the major papers that examine the determinants of capital structure. Baker and Wurgler's (2002) market timing theory is introduced with the important implication that capital structure is the cumulative outcome of past attempts to time the equity market. This provides the primary motivation for this thesis. Although prior studies have investigated the impact of taxes, agency costs and information asymmetry, it is noted, that several issues have not been examined in the context of Australian capital structure (for example, the impact of market timing, comparison of mining and non-mining firm and the impact of liquidity).

Research methodology and data that are used in the thesis are described in Chapters 3 and 4 respectively. Pooled OLS is used, consistent with much of the literature, and fixed effect panel analysis are used to capture possible information and estimation efficiency gains as well as to control for the possibility of individual firm unobserved heterogeneity. Three different data sets are used in the analysis; Baker and Wurgler (2002) filtered data, unfiltered data, and four standard deviation filtered data. The underlying data set consists of all listed and delisted companies from Fin Analysis and Dat Analysis for the period, 1997 to 2005 (Aspect Huntley). Further, three liquidity measures are used in the final analysis chapter (bid-ask spread, volume of trade and zero-return). These are collected from DataStream for the period, 2001 to 2005.

Chapter 5, reports the results from Baker and Wurgler (2002) type tests for the impact of market timing theory on financing choice in Australia. The study suggests that market timing may have an impact on the capital structure choice of Australian firms. The market-to-book effect appears to be explained by net equity issues, consistent with the theory of market timing. However, the results are sensitive to the data set and method used in the analysis. When four standard deviation filtered data is used, it is found that market-to-book has a more significant impact on leverage than the external weighted average market-to-book (past market-to-book), thus not supporting the hypothesis that past market-to-book is the single most important variable to explain the cross sections variation in leverage (Baker & Wurgler 2002). Hence, with a four standard deviation filtered data while market timing appears to

affect capital structure choice for Australian firms, there is little support for the hypothesis that past market timing decisions have a long lasting impact on Australian firm capital structure. Market timing effects appear to be localized to the large firm sample captured by the Baker and Wurgler (2002) filter.

Chapter 6 evaluates the Hovakimian (2006) argument for Australian firms to see whether past market-to-book actually reflects growth opportunities. Consistent with the findings reported in previous literature, there is support for the hypothesis that past market-to-book is related to observed capital structure because it contains information about growth opportunities. However, this result is also somewhat sensitive to filter choice. Furthermore, when weighted average future market-to-book ratios replace the weighted average of past market-to-book ratios, it is found that current leverage is also related to future weighted average market-to-book. This is not consistent with market timing but it is consistent with past market-to-book ratios reflecting future growth opportunities. Overall, it is evident that capital structure choice is unlikely to be due solely to equity market timing but it would appear growth opportunities provide a reasonable explanation for the current market-to-book ratio effect noted by Baker and Wurgler (2002).

In the next chapter (Chapter 7), the capital structure decisions for Australian mining and non-mining firms are subject to investigation. Using dummy variables within the Baker and Wurgler (2002) and Hovakimian (2006) models, Chapter 7 reveals evidence for differences in the determinants of capital structure choice of mining and non-mining firms. The results are also sensitive to data filter choice. In general growth opportunities provide a reasonable explanation for the past market-to-book ratio effect for both Australian mining and non-mining firms. Sensitivity to the capital structure explanatory variables varies between these two groups.

Chapter 8 completes the empirical analysis. This involves analysis of the capital structure of Australian firms in the presence of liquidity effects within the Baker and Wurgler (2002) and Hovakimian (2006) framework. Specifically, the study introduces liquidity interaction terms in analysis of the leverage choice of Australian firms. The interaction term analysis highlights the variation in results across data filters and alternate models, specifically, the lack of interaction evident for the market-to-book effect in the Baker and Wurgler (2002) filtered data compared with

the unfiltered data and a four standard deviation filtered data. Filter choice clearly plays a role in statistical analysis of firm corporate capital structure choice. Regardless, there is also evidence that greater liquidity is associated with less sensitivity of leverage to cash flow. More liquid firms tend to have lower leverage. There is a tendency for firm leverage to revert towards a long run value and this is sensitive to liquidity regardless of the model. Finally, this study highlights the role of liquidity on the corporate financing decision and finds evidence that liquidity has a significant impact on Australian capital structure.

9.3 KEY CONTRIBUTIONS OF THE THESIS

This study explores the impact of market timing theory using three different filters and two analytical methods (pooled OLS and fixed effects specification) using a large sample of Australian firms in analysis of capital structure choice. The study also explores the determinants of leverage for mining and non-mining firm separately within the Baker and Wurgler (2002) and Hovakimian (2006) framework. Finally, study of the impact of liquidity on Australian capital structure choice forms a key extension to the Baker and Wurgler (2002) and Hovakimian (2006) models in this thesis. Although the issue of capital structure based on market timing theory and liquidity has been addressed in the previous literature, a major contribution of this thesis is the investigation of these issues within an Australian capital markets context. Specifically, the contributions pertain to two broad categories – (i) the impact of market timing theory; and (ii) the impact of liquidity.

Some of the major findings presented in this thesis include:

- Exploration of the market timing theory considering a new data set (Australian firms) that has not yet been reported in the literature.

- Panel data analysis with fixed effect specification provides an important extension to the pooled OLS analysis that is generally reported.

- It is not possible to completely reject the hypothesis that market timing has some impact on the capital structure choice of Australian firms.

- There is evidence that the effect of market-to-book is explained by net equity issues, consistent with the theory of market timing.

- Many of the statistical results are sensitive to data filter choice with variation in the strength of the negative relationship observed between past market-to-book and leverage.

- There is little support for the hypothesis that past market timing decisions have a long lasting impact on Australian firm capital structure.

- Empirical evidence suggests that current leverage is also related to future weighted average market-to-book when weighted average future market-to-book ratio replaces the weighted average past market-to-book ratio. These results support the hypothesis that past market-to-book contains information about future growth opportunities.

In summary, there is Australian firm based evidence that the capital structure choice is unlikely to be due solely to equity market timing. Growth opportunities provide a reasonable explanation for the current market-to-book ratio effect noted by Baker and Wurgler (2002).

- An investigation of the mining and non-mining firms provides some evidence that there is significant difference in the determinants of capital structure across mining and non-mining firms though the differences are sensitive to data filters and statistical method.

The capital structure of Australian firms is found to be sensitive to liquidity effects (within the Baker and Wurgler (2002) and Hovakimian (2006) framework). Some of the results are also sensitive to data filter choice.

- Lack of market-to-book effects in the Baker and Wurgler (2002) filtered data compared with the unfiltered data and a four standard deviation filtered data suggest that the Baker and Wurgler (2002) filtered data focuses on large firms and their leverage is not sensitive to market conditions.

- Liquid firms tend to have lower leverage and greater liquidity is associated with less sensitivity of leverage to cash flow. Also there is evidence that the tendency to revert towards some long run leverage value is positively related with liquidity.

9.4 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Capital structure choice, the core issue that is examined by this thesis, is a broad area and a well documented area in the field of research in finance. Given the importance of the determinants of capital structure, this issue has become increasingly important from an empirical point-of-view. Yet, there is a lack of the capital structure choice literature dealing with Australian firms.

The analysis of market timing, growth opportunities and liquidity that are examined in the preceding chapters addresses a number of important questions that have been investigated in prior studies. In addition, the thesis explores the variation between mining and non-mining firm that have not been articulated specifically in the capital structure literature. Thus, the empirical methodology applied in this thesis is used to examine a number of potential explanations for capital structure choice of Australian firms.

However, as with most studies, the respective investigations undertaken in the thesis have given rise to some questions that could provide further insight into the capital structure choice. These include the following. The use of a common divisor in calculation of the variables used in the analysis raises some questions about measurement error that has been the subject of discussion in recent research. A range of alternative measures (for example, market value of assets, market capitalization) could be used instead. Further analysis of this question is beyond the scope of the current thesis. The study uses all available firms over a nine year period and this provides a useful sample for analysis. However, it would be interesting to study the capital structure choice of Australian firms beginning at their IPO consistent with Baker and Wurgler (2002). The period of study used throughout this thesis is from 1997 to 2005 and the data is mostly obtained from FinAnalysis, DatAnalysis and DataStream. A longer study period with different sources of data could be an

important extension to further assess the robustness of the results found in this thesis. The calculation of market-to-book ratio differs in Australia relative to the US. Yet, the findings of this thesis especially using the Baker and Wurgler (2002) filtered data and the Baker and Wurgler (2002) model are consistent with US results. Another possible extension could be to use of the market-to-book ratio with an Australian definition.

The Baker and Wurgler (2002) filtered data is set to minimum Aus$10 million asset value threshold to be consistent with the Baker and Wurgler (2002) US study. However, compared to the US (US$10 million in assets is a micro-firm); this size is about the average size of an IPO in Australia. This arbitrary choice of size threshold might affect the results. Thus, analysing the sensitivity of size is left for future research.

The Baker and Wurgler (2002) filtered data results, using pooled OLS estimates, provide support for Baker and Wurgler (2002) and Hovakimian (2006) arguments but it seems that pooled OLS estimates may not be entirely valid as the fixed effect method does not always support the pooled OLS result. This was one of the reasons for including fixed effects analysis as well as pooled OLS.

This thesis addresses one aspect (structural change) of capital structure choice by separating the sample into mining and non-mining firm in chapter 7. While there are some differences, further analysis of this issue is left for future work.

The data used for the liquidity measures is subject to availability from DataStream. A possible extension could involve analysis of more extensive liquidity based data sets as they become available.

The analysis shows that including a number of parameters in the regression could lead to multicolinearity problems which result in less precise measurement of the coefficients. For example, the Baker and Wurgler (2002) and Hovakimian (2006) results are not particularly robust for Australian firms and this provides one area for future work. Finally, Strebulaev (2007) investigates the empirical implications of capital structure research and argues that there is need to rethink the tests that are conducted. Further analysis of capital structure statistical tests is left to future research.

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APPENDICES

A5.1: Variable Definitions

Variable	Definition
D, Book debt	Total assets minus book equity
E, Book equity	Total Assets less total liabilities
$\left(\frac{D}{A}\right)$, Book leverage	Book debt to total assets
$\left(\frac{D}{A}\right)^{*}$, Market leverage	Book debt divided by total assets minus book equity plus market equity
$\left(\frac{D}{A}\right)_{t} - \left(\frac{D}{A}\right)_{t-1}$	Change in book value of leverage
$E^{/}$, Market equity	Common shares outstanding times price
$\left(\frac{M}{B}\right)$, Market-to-book-ratio	Assets minus book equity plus market equity all divided by total assets.
e/A, Net equity issues	Change in the book equity minus change in the balance sheet retained earnings divided by assets
d/A, Net debt issues	Residual changes in assets divided by assets. Here residual changes in assets mean changes in total assets minus changes in retained earnings
$\Delta RE/A$, Newly retained profits	Change in the retained earnings divided by assets
$\left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right]$, Residual changes in leverage	Lagged book equity divided by total assets minus lagged book equity divided by lagged total assets
$\left(PPE/A\right)_t$, Fixed asset tangibility	Net property, plan and equipment divided by total assets
$\left(EBITDA/A\right)_t$, Profitability	Operating income or earnings before interest, taxes, depreciation and amortization divided by total assets
$\log(S)_t$, Firm size	Natural logarithm of total revenue
$EFWAMB_t$, External finance weighted average market-to-book ratio	Total summation of net equity and net debt issues divided by the sum of net debt and net equity issues times the market-to-book ratio

A7.1: Baker and Wurgler (2002) filtered data: Determinants of change in leverage and components

Analysis of annual change in book leverage and its components with respect to market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using Baker and Wurgler (2002) filtered data for Mining and Non-mining firms. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Book value of leverage is defined as book debt to assets, $\left(\frac{D}{A}\right)_t$ at time t. The market-to-book ratio $\left(\frac{M}{B}\right)$ is equal to assets minus book equity plus market equity divided by assets. Fixed assets tangibility, $\left(\frac{PPE}{A}\right)$ is defined as net property, plant and equipment divided by assets. Profitability, $\left(\frac{EBITDA}{A}\right)$ is defined as operating income before interest, taxes, depreciation and amortization. Firm size is defined as the log of total revenue, ($Log(S)_{t-1}$). The explanatory variables are measured at time, t-1. Panel A reports the annual change in leverage. Effect of net equity issues is reported in panel B where net equity issues, $\left(\frac{e_t}{A_t}\right)$ is defined as the change in book equity minus the change in retained earnings divided by assets. The newly retained earnings component is reported in Panel C and it is $\left(\frac{\Delta RE_t}{A_t}\right)$ defined as the change in retained earnings divided by assets. Finally, panel D reports the components of residual change in leverage $E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)$ that depends on the total growth in assets[47]. Robust *t*-statistics are reported in parentheses.

[47] The total growth in assets is the combination of net equity issues, net debt issues and newly retained earnings.

A7.1: Baker and Wurgler (2002) filtered data: Determinants of change in leverage and components (continued)

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*F*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Mining Firms, N=857											
Pooled OLS	0.003	(0.31)	0.003	(0.23)	-0.022	(-0.46)	0.013	(3.38)	-0.235	(-6.98)	0.09
Fixed effects	0.002	(0.19)	0.009	(0.67)	0.008	(0.19)	0.011	(3.36)	-0.242	(-6.81)	0.34
Non-mining Firms N=2738											
Pooled OLS	-0.005	(-2.33)	0.009	(3.44)	-0.019	(-0.58)	0.011	(3.56)	-0.178	(-20.47)	0.09
Fixed effects	-0.006	(-2.11)	0.010	(4.36)	-0.033	(-0.99)	0.009	(2.91)	-0.177	(-12.94	0.29
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Mining Firms											
Pooled OLS	-0.074	(-4.76)	-0.019	(-0.56)	0.018	(0.16)	0.053	(2.55)	-0.322	(-1.23)	0.01
Fixed effects	-0.043	(-5.86)	-0.040	(-0.82)	0.109	(1.40)	0.060	(2.75)	-0.194	(-1.72)	0.35
Other Firms											
Pooled OLS	-0.043	(-10.57)	-0.006	(-0.73)	0.117	(2.15)	0.039	(3.96)	-0.066	(-1.21)	0.04
Fixed effects	-0.040	(-7.29)	-0.009	(-1.62)	0.106	(1.82)	0.043	(2.92)	-0.061	(-0.99)	0.23
Panel C: Changes in Book Leverage through Newly Retained Earnings $(-(\Delta RE/A_t))$											
Mining Firms											
Pooled OLS	-0.043	(-1.54)	0.051	(0.93)	0.097	(2.67)	0.017	(1.17)	-0.289	(-1.32)	0.01
Fixed effects	-0.061	(-0.99)	-0.029	(-0.46)	0.128	(1.33)	0.036	(1.27)	-0.353	(-1.04)	0.28
Non-mining Firms											
Pooled OLS	0.002	(0.24)	-0.003	(-1.39)	0.088	(1.17)	-0.028	(-1.88)	0.014	(0.37)	0.002
Fixed effects	-0.010	(-0.81)	0.000	(-0.16)	0.099	(1.67)	-0.026	(-1.40)	0.056	(1.82)	0.29

A7.1: Baker and Wurgler (2002) filtered data: Determinants of change in leverage and components (continued)

Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*F*	*t(f)*	R^2
Mining Firms											
Pooled OLS	0.040	(1.86)	0.008	(0.37)	0.029	(0.35)	-0.020	(-2.72)	0.042	(0.71)	0.01
Fixed effects	0.018	(0.50)	0.009	(0.46)	-0.064	(-0.28)	-0.026	(-1.28)	0.068	(0.55)	0.20
Non-mining Firms											
Pooled OLS	0.032	(2.07)	0.019	(0.96)	0.190	(4.43)	-0.007	(-0.62)	0.053	(0.69)	0.01
Fixed effects	0.048	(2.43)	0.019	(1.03)	0.114	(1.87)	-0.009	(-0.67)	0.019	(0.20)	0.26

A7.2: Unfiltered data: Determinants of change in leverage and components

Analysis of annual change in book leverage and its components of market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using unfiltered data for Mining and Non-mining firms. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

Refer to the above table for the model and variable definitions. Robust *t*-statistics are reported in parentheses.

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Mining Firms, N=1479											
Pooled OLS	-0.389	(-1.80)	-0.047	(-1.33)	-0.726	(-123.9)	-0.550	(-1.20)	-0.499	(-1.79)	0.54
Fixed effects	-0.364	(-1.58)	-0.133	(-0.70)	-0.724	(-152.8)	-0.422	(-0.99)	-0.528	(-1.76)	0.62
Non-mining Firms N=3460											
Pooled OLS	-0.006	(-0.88)	0.001	(0.48)	-0.002	(-0.39)	0.052	(2.65)	-0.965	(-41.63)	0.49
Fixed effects	-0.012	(-0.85)	0.003	(1.54)	-0.005	(-0.58)	0.059	(2.93)	-0.955	(-31.59)	0.56
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Mining Firms											
Pooled OLS	0.006	(0.10)	-0.020	(-2.23)	-0.002	(-1.61)	0.084	(4.35)	-0.010	(-0.14)	0.01
Fixed effects	0.026	(0.41)	-0.017	(-1.14)	-0.002	(-1.30)	0.078	(5.57)	-0.037	(-0.45)	0.23
Non-mining Firms											
Pooled OLS	-0.039	(-5.05)	-0.001	(-0.07)	-0.020	(-3.54)	0.077	(5.02)	0.044	(2.93)	0.04
Fixed effects	-0.039	(-4.34)	-0.002	(-0.6)	-0.021	(-3.14)	0.073	(4.01)	0.037	(1.88)	0.23

A7.2: Unfiltered data: Determinants of change in leverage and components (continued)

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel C: Changes in Book Leverage through Newly Retained Earnings $\left(-\left(\Delta RE / A_t\right)\right)$											
Mining Firms											
Pooled OLS	-0.465	(-1.47)	-0.065	(-1.07)	-0.160	(-11.14)	-0.990	(-1.62)	0.584	(1.43)	0.01
Fixed effects	-0.481	(-1.46)	-0.229	(-0.69)	-0.157	(-14.4)	-0.888	(-1.29)	0.607	(1.42)	0.19
Non-mining Firms											
Pooled OLS	0.004	(0.18)	-0.009	(-0.87)	-0.001	(-0.05)	-0.251	(-2.50)	-0.049	(-1.08)	0.01
Fixed effects	-0.026	(-0.45)	-0.005	(-0.49)	-0.019	(-0.54)	-0.214	(-2.23)	0.020	(0.21)	0.15
Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$											
Mining Firms											
Pooled OLS	0.071	(0.51)	0.038	(1.54)	-0.565	(-60.7)	0.355	(1.96)	-1.072	(-5.88)	0.85
Fixed effects	0.088	(0.59)	0.112	(0.83)	-0.565	(-72.9)	0.388	(1.45)	-1.095	(-5.65)	0.88
Non-mining Firms											
Pooled OLS	0.028	(1.46)	0.011	(0.93)	0.019	(1.51)	0.226	(2.84)	-0.961	(-15.29)	0.05
Fixed effects	0.053	(1.15)	0.009	(0.87)	0.035	(1.20)	0.200	(2.64)	-1.012	(-11.65)	0.18

A7.3: Four Standard Deviation filtered data: Determinants of change in leverage and components

Analysis of annual change in book leverage and its components of market-to-book ratio, fixed assets, profitability, firm size and lagged leverage using four standard deviation filtered data for Mining and Non-mining firms. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t - \left(\frac{D}{A}\right)_{t-1} = -\left(\frac{e_t}{A_t}\right) - \left(\frac{\Delta RE_t}{A_t}\right) - \left[E_{t-1}\left(\frac{1}{A_t} - \frac{1}{A_{t-1}}\right)\right] = a + b\left(\frac{M}{B}\right)_{t-1} + c\left(\frac{PPE}{A}\right)_{t-1} + d\left(\frac{EBITDA}{A}\right)_{t-1} + e\log(S)_{t-1} + f\left(\frac{D}{A}\right)_{t-1} + u_t$$

Refer to A7.2 for the model and variable definitions. Robust *t*-statistics are reported in parentheses.

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*T(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Changes in Book Leverage $(\Delta(D/A)_t)$											
Mining Firms, N=1400											
Pooled OLS	-0.009	(-0.70)	0.095	(1.80)	-0.025	(-2.17)	0.024	(1.60)	-0.426	(-2.62)	0.24
Fixed effects	-0.010	(-0.74)	0.103	(2.28)	-0.024	(-2.14)	0.023	(1.54)	-0.417	(-2.77)	0.38
Non-mining Firms N=3281											
Pooled OLS	0.003	(0.85)	0.032	(1.17)	0.062	(1.59)	0.030	(2.14)	-0.546	(-7.21)	0.27
Fixed effects	0.003	(0.71)	0.042	(1.33)	0.061	(1.77)	0.030	(1.86)	-0.541	(-8.50)	0.41
Panel B: Changes in Book Leverage through Net Equity Issues $(-e/A_t)$											
Mining Firms											
Pooled OLS	-0.008	(-0.11)	-0.222	(-2.50)	-0.022	(-0.43)	0.065	(1.48)	0.388	(0.85)	0.03
Fixed effects	-0.004	(-0.06)	-0.281	(-3.18)	-0.021	(-0.49)	0.056	(1.81)	0.401	(0.96)	0.22
Non-mining Firms											
Pooled OLS	-0.046	(-3.39)	-0.032	(-0.88)	0.084	(1.30)	0.072	(6.86)	-0.122	(-1.17)	0.06
Fixed effects	-0.047	(-3.74)	-0.015	(-0.33)	0.080	(1.35)	0.070	(5.19)	-0.144	(-1.30)	0.21

A7.3: Four Standard Deviation filtered data: Determinants of change in leverage and components (continued)

	M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$(D/A)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*T(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel C: Changes in Book Leverage through Newly Retained Earnings $\left(-\left(\Delta RE / A_t\right)\right)$											
Mining Firms											
Pooled OLS	-0.022	(-0.26)	0.123	(0.78)	-0.044	(-0.98)	-0.008	(-0.13)	-1.242	(-1.59)	0.09
Fixed effects	-0.018	(-0.23)	0.212	(1.03)	-0.044	(-1.15)	-0.020	(-0.47)	-1.227	(-1.70)	0.25
Non-mining Firms											
Pooled OLS	0.020	(1.86)	0.009	(0.12)	-0.147	(-1.48)	-0.094	(-4.42)	-0.382	(-2.31)	0.02
Fixed effects	0.024	(2.19)	-0.015	(-0.18)	-0.155	(-1.80)	-0.092	(-4.90)	-0.391	(-2.10)	0.23
Panel D: Changes in Book Leverage through Growth in Assets $-\left[E_{t-1}\left(\frac{1}{A_t}-\frac{1}{A_{t-1}}\right)\right]$											
Mining Firms											
Pooled OLS	0.021	(0.82)	0.194	(1.76)	0.041	(7.30)	-0.033	(-1.36)	0.428	(1.33)	0.03
Fixed effects	0.012	(0.52)	0.172	(1.33)	0.042	(6.05)	-0.013	(-0.54)	0.408	(1.36)	0.19
Non-mining Firms											
Pooled OLS	0.029	(4.37)	0.054	(0.58)	0.125	(3.17)	0.053	(2.76)	-0.042	(-0.31)	0.01
Fixed effects	0.027	(4.81)	0.073	(0.64)	0.136	(3.89)	0.053	(2.93)	-0.006	(-0.04)	0.21

A7.4: Baker and Wurgler (2002) filtered data: Determinants of leverage

Mining and non-mining firms analysis of annual changes in book leverage and market leverage on the market-to-book ratio, fixed assets, profitability and firm size using Baker and Wurgler (2002) filtered data for the full period of 1997 to 2005. Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t$$

The intercept, a, is not reported. N is the number of observations used in the analysis. Leverage, $\left(\frac{D}{A}\right)_t$ is defined in two ways, book debt to assets (book value) and book debt to the results of total assets minus book equity plus market equity (market value) both at times t. The market-to-book ratio $\left(\frac{M}{B}\right)$, is also defined in two ways. The first one is external finance weighted average market-to-book ratio (EFWAMB) from the year 1997 to year t-1. The weight set to zero if this is negative. And the second is the market-to-book ratio in year t-1, which is defined as assets minus book equity plus market equity all divided by assets. Fixed assets tangibility $\left(\frac{PPE}{A}\right)$, is defined as net property, plant and equipment divided by assets. Profitability $\left(\frac{EBITDA}{A}\right)$ is defined as operating income before interest, taxes, depreciation and amortization. Firm size is defined as the log of total revenue $Log(S)_{t-1}$.The explanatory variables are measured at time, t-1. Firm year observations are dropped where EFWAMB exceeds 10. Panel A report the results for book value of leverage and panel B reports the results for market value of leverage. Robust *t*-statistics are reported in parentheses.

A7.4: Baker and Wurgler (2002) filtered data: Determinants of leverage (continued)

	$(EFWAMB)_t$			M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*E*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Mining Firms, N=857											
Pooled OLS	-0.024	(-3.79)	0.039	(3.40)	0.007	(0.26)	-0.003	(-0.07)	0.078	(21.17)	0.30
Fixed effects	-0.024	(-3.82)	0.043	(4.26)	0.012	(0.52)	0.003	(0.10)	0.077	(13.12)	0.49
Non-mining Firms N=2738											
Pooled OLS	-0.007	(-3.31)	-0.016	(-6.39)	0.032	(3.25)	-0.013	(-0.42)	0.102	(40.40)	0.27
Fixed effects	0.004	(1.58)	-0.020	(-5.29)	0.033	(4.40)	-0.042	(-1.44)	0.098	(26.07)	0.44
Panel B: Market Leverage											
Mining Firms											
Pooled OLS	-0.027	(-6.00)	-0.049	(-5.72)	-0.001	(-0.06)	-0.062	(-3.12)	0.066	(19.01)	0.29
Fixed effects	-0.017	(-3.75)	-0.044	(-5.05)	-0.002	(-0.11)	-0.110	(-3.22)	0.066	(11.81)	0.51
Non-mining Firms											
Pooled OLS	-0.018	(-8.98)	-0.083	(-21.45)	0.032	(3.20)	-0.071	(-2.84)	0.066	(21.16)	0.30
Fixed effects	-0.005	(-1.67)	-0.088	(-23.53)	0.035	(5.03)	-0.081	(-2.81)	0.065	(14.01)	0.47

A7.5: Unfiltered data: Determinants of leverage

Both pooled ordinary least squares and fixed effects panel analysis are used for the model below.

$$\left(\frac{D}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log(S)_{t-1} + u_t$$

Refer to the above table for the variable definitions. Robust *t*-statistics are reported in parentheses.

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*E*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Mining Firms, N=1479											
Pooled OLS	-0.029	(-1.19)	0.002	(0.43)	-0.047	(-1.45)	-0.715	(-123.5)	-0.393	(-1.05)	0.33
Fixed effects	-0.034	(-0.88)	0.006	(0.63)	-0.147	(-0.78)	-0.712	(-77.78)	-0.288	(-0.81)	0.44
Non-mining Firms N=3460											
Pooled OLS	-0.004	(-0.69)	0.003	(0.80)	0.001	(0.51)	0.003	(1.00)	0.058	(3.21)	0.002
Fixed effects	-0.008	(-0.75)	0.001	(0.20)	0.003	(1.52)	0.001	(0.31)	0.068	(3.86)	0.15
Panel B: Market Leverage											
Mining Firms											
Pooled OLS	-0.002	(-2.12)	0.0001	(0.70)	0.002	(0.33)	-0.001	(-5.02)	0.072	(46.58)	0.30
Fixed effects	0.001	(-0.79)	0.002	(-0.55)	-0.001	(-0.25)	-0.001	(-9.32)	0.068	(22.42)	0.51
Non-mining Firms											
Pooled OLS	-0.015	(-11.47)	-0.005	(-2.01)	0.004	(1.44)	-0.003	(-1.74)	0.077	(20.22)	0.22
Fixed effects	-0.012	(-7.65)	-0.005	(-1.94)	0.005	(2.15)	-0.003	(-1.77)	0.076	(18.15)	0.42

A7.6: Four Standard Deviation filtered data: Determinants of leverage

Both pooled ordinary least squares and fixed effects panel analyses are used for the model below using mining and non-mining firms.

$$\left(\frac{D}{A}\right)_t = a + b\left(EFWAMB\right)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + f\log\left(S\right)_{t-1} + u_t$$

Refer to A7.5 for the variable definitions. Robust *t*-statistics are reported in parentheses.

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Book Leverage											
Mining Firms, N=1400											
Pooled OLS	0.007	(0.69)	0.046	(3.92)	0.124	(2.05)	-0.019	(-1.25)	0.078	(13.14)	0.10
Fixed effects	0.011	(0.91)	0.049	(3.74)	0.140	(2.32)	-0.016	(-1.17)	0.074	(9.85)	0.27
Non-mining Firms N=3281											
Pooled OLS	-0.001	(-0.23)	0.008	(1.42)	0.069	(2.31)	-0.039	(-1.43)	0.083	(11.46)	0.06
Fixed effects	-0.001	(-0.20)	0.008	(1.35)	0.084	(2.64)	-0.041	(-1.75)	0.084	(8.38)	0.24
Panel B: Market Leverage											
Mining Firms											
Pooled OLS	-0.003	(-3.28)	-0.008	(-2.75)	0.104	(5.05)	-0.002	(-1.16)	0.061	(29.06)	0.33
Fixed effects	0.000	(-0.12)	-0.009	(-3.17)	0.121	(4.92)	-0.003	(-2.19)	0.056	(22.35)	0.49
Non-mining Firms											
Pooled OLS	-0.003	(-1.48)	-0.016	(-3.21)	0.092	(12.13)	-0.013	(-2.12)	0.070	(29.80)	0.24
Fixed effects	-0.001	(-0.51)	-0.017	(-4.01)	0.086	(10.28)	-0.017	(-2.67)	0.069	(21.52)	0.41

A7.7: Determinants of Book Leverage: All Filters

Both pooled ordinary least squares and fixed effects panel analyses are used for the model below using mining and non-mining firms.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1} + u_t$$

Here, leverage is defined as, long-term debt + short-term debt over total assets. The EFWAMB is external finance weighted average market-to-book ratio. Cumulative net equity issued is the net equity issued divided by total assets cumulated over all years preceding the current year and cumulative net debt issued is the net debt issued divided by total assets cumulated over all years preceding the current year (net debt issued is measured as the change in long term plus short term debt). Refer to A7.5 for definition of other control variables.

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		*EqIs*		*DbIs*		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel A: Baker and Wurgler filtered data															
Mining Firms, N=857															
Pooled OLS	-0.012	(-3.51)	0.017	(1.62)	0.011	(0.51)	-0.103	(-2.95)	0.040	(12.1)	-0.014	(-0.59)	0.268	(5.56)	0.23
Fixed effects	-0.007	(-1.07)	0.011	(0.97)	0.010	(0.54)	-0.146	(-3.71)	0.041	(8.86)	-0.005	(-0.21)	0.243	(5.63)	0.47
Non-mining Firms N=2738															
Pooled OLS	-0.005	(-2.86)	-0.020	(-10.5)	0.049	(2.05)	-0.004	(-0.18)	0.045	(17.4)	-0.012	(-3.40)	0.146	(6.36)	0.21
Fixed effects	0.001	(1.05)	-0.020	(-11.0)	0.054	(2.73)	-0.035	(-1.33)	0.046	(14.0)	-0.011	(-3.17)	0.146	(6.59)	0.41
Panel B: Unfiltered data															
Mining Firms, N=1479															
Pooled OLS	-0.002	(-0.05)	-0.002	(-1.03)	-0.034	(-1.09)	-0.707	(-139.6)	-0.056	(-0.34)	-0.020	(-0.57)	0.023	(0.1)	0.60
Fixed effects	0.010	(0.36)	-0.005	(-1.58)	-0.147	(-0.79)	-0.704	(-136.9)	-0.164	(-0.62)	-0.016	(-0.3)	-0.048	(-0.22)	0.68
Non-mining Firms N=3460															
Pooled OLS	0.001	(0.96)	-0.002	(-2.3)	0.005	(1.49)	-0.002	(-1.21)	0.043	(10.4)	0.000	(0.59)	0.013	(2.39)	0.02
Fixed effects	0.002	(1.38)	-0.003	(-1.49)	0.006	(1.88)	-0.003	(-1.16)	0.045	(6.75)	0.000	(0.67)	0.016	(2.79)	0.19

A7.7: Determinants of Book Leverage: All Filters (continued)

Panel C: Four Standard Deviation filtered data

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		*EqIs*		*DbIs*		
Different Estimates	*b*	*t(b)*	*c*	*t©*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Mining Firms, N=1400															
Pooled OLS	0.029	(1.91)	0.005	(0.43)	0.089	(1.84)	-0.020	(-1.62)	0.033	(5.83)	0.0001	(2.96)	0.012	(2.21)	0.08
Fixed effects	0.042	(2.17)	0.001	(0.09)	0.088	(1.64)	-0.018	(-1.62)	0.028	(3.20)	0.0001	(0.17)	0.012	(1.64)	0.26
Non-mining Firms N=3281															
Pooled OLS	0.001	(0.15)	-0.005	(-2.88)	0.140	(8.80)	-0.014	(-2.11)	0.043	(13.31)	-0.004	(-1.28)	-0.001	(-0.38)	0.06
Fixed effects	0.002	(1.06)	-0.006	(-2.92)	0.145	(8.21)	-0.014	(-2.45)	0.039	(9.83)	-0.002	(-0.67)	-0.002	(-0.56)	0.26

A7.8: Determinants of Changes in Book Leverage: All Filters

Both pooled ordinary least squares and fixed effects panel analyses are used for the model below using mining and non-mining firms.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

Change in leverage is defined as the leverage (t) minus leverage (t-1). Refer to A7.5 for definition of other control variables. Robust *t*-statistics are reported in parentheses.

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t©*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data													
Mining Firms, N=857													
Pooled OLS	-0.009	(-4.35)	0.012	(1.48)	0.003	(0.29)	-0.044	(-1.73)	0.014	(2.47)	-0.375	(-4.42)	0.17
Fixed effects	-0.008	(-1.70)	0.007	(0.62)	0.002	(0.18)	-0.072	(-2.52)	0.015	(3.12)	-0.413	(-5.35)	0.41
Non-mining Firms N=2738													
Pooled OLS	-0.005	(-3.99)	-0.003	(-1.97)	0.017	(2.28)	-0.003	(-0.23)	0.011	(2.79)	-0.266	(-3.69)	0.13
Fixed effects	-0.004	(-4.08)	-0.003	(-1.98)	0.019	(3.13)	-0.017	(-1.05)	0.012	(3.56)	-0.260	(-4.29)	0.36
Panel B: Unfiltered data													
Mining Firms, N=1479													
Pooled OLS	-0.037	(-1.61)	0.002	(0.44)	-0.036	(-1.25)	-0.682	(-42.5)	-0.063	(-0.39)	-0.917	(-18.48)	0.61
Fixed effects	-0.017	(-0.73)	-0.002	(-0.32)	-0.147	(-0.79)	-0.692	(-43.0)	-0.166	(-0.63)	-0.955	(-19.25)	0.69
Non-mining Firms N=3460													
Pooled OLS	-0.003	(-2.70)	-0.011	(-3.34)	0.003	(1.37)	-0.007	(-3.32)	0.029	(6.52)	-0.759	(-14.64)	0.40
Fixed effects	-0.002	(-1.48)	-0.012	(-3.22)	0.004	(1.83)	-0.007	(-2.96)	0.032	(5.82)	-0.772	(-17.84)	0.50

A7.8: Determinants of Changes in Book Leverage: All Filters (continued)

	$(EFWAMB)_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t©*	*D*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel C: Four Standard Deviation filtered data													
Mining Firms, N=1400													
Pooled OLS	0.001	(0.07)	-0.008	(-0.59)	0.055	(1.32)	-0.025	(-2.26)	0.015	(1.81)	-0.450	(-2.54)	0.26
Fixed effects	0.006	(0.41)	-0.012	(-0.81)	0.055	(1.40)	-0.023	(-2.08)	0.015	(1.29)	-0.450	(-2.72)	0.40
Non-mining Firms N=3281													
Pooled OLS	0.0001	(0.06)	-0.003	(-0.97)	0.053	(1.83)	0.038	(1.66)	0.021	(2.74)	-0.632	(-9.36)	0.29
Fixed effects	0.002	(0.66)	-0.004	(-1.32)	0.061	(1.80)	0.034	(1.72)	0.019	(2.26)	-0.656	(-11.42)	0.44

A7.9: Future EFWAMB and Capital Structure: All Filters

Both pooled ordinary least squares and fixed effects panel analyses are used for the model below using mining and non-mining firms.

$$\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + u_t$$

The FEFWAMB is external finance weighted average of future market-to-book ratio. Refer to A7.5 for definition of other control variables. Robust *t*-statistics are reported in parentheses.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel A: Baker and Wurgler filtered data											
Mining Firms, N=857											
Pooled OLS	-0.007	(-1.92)	0.020	(1.84)	0.010	(0.52)	-0.122	(-2.47)	0.036	(8.46)	0.10
Fixed effects	-0.008	(-1.32)	0.017	(1.21)	0.006	(0.36)	-0.170	(-3.46)	0.036	(6.50)	0.40
Non-mining Firms N=2738											
Pooled OLS	-0.006	(-3.87)	-0.021	(-6.59)	0.051	(2.22)	0.032	(1.59)	0.046	(18.99)	0.15
Fixed effects	-0.011	(-4.30)	-0.018	(-7.34)	0.056	(3.02)	-0.003	(-0.15)	0.050	(15.58)	0.37
Panel B: Unfiltered data											
Mining Firms, N=1479											
Pooled OLS	-0.002	(-1.06)	-0.001	(-0.85)	-0.038	(-1.21)	-0.706	(-235.7)	-0.102	(-0.52)	0.60
Fixed effects	-0.001	(-0.77)	-0.002	(-0.78)	-0.159	(-0.81)	-0.705	(-189.3)	-0.238	(-0.73)	0.68
Non-mining Firms N=3460											
Pooled OLS	-0.004	(-3.95)	-0.003	(-2.65)	0.005	(1.45)	-0.003	(-1.37)	0.044	(7.65)	0.02
Fixed effects	-0.003	(-200)	-0.003	(-1.48)	0.006	(1.81)	-0.004	(-1.15)	0.047	(6.25)	0.19

A7.9: Future EFWAMB and Capital Structure: All Filters (continued)

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	R^2
Panel C: Four Standard Deviation filtered data											
Mining Firms, N=1400											
Pooled OLS	-0.011	(-4.19)	0.048	(3.18)	0.046	(0.73)	-0.022	(-1.67)	0.041	(5.40)	0.05
Fixed effects	-0.010	(-2.81)	0.053	(3.11)	0.053	(0.88)	-0.020	(-1.83)	0.040	(4.50)	0.22
Non-mining Firms N=3281											
Pooled OLS	-0.005	(-5.58)	-0.005	(-2.80)	0.136	(6.85)	-0.021	(-2.06)	0.044	(17.53)	0.06
Fixed effects	-0.006	(-2.98)	-0.005	(-2.52)	0.142	(6.23)	-0.022	(-2.02)	0.040	(11.71)	0.27

A7.10: Future EFWAMB and Changes in leverage: All Filters

Both pooled ordinary least squares and fixed effects panel analyses are used for the model below using mining and non-mining firms.

$$\Delta\left(\frac{LT+ST}{A}\right)_t = a + b(FEFWAMB)_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g\left(\frac{LT+ST}{A}\right)_{t-1} + u_t$$

The FEFWAMB is external finance weighted average of future market-to-book ratio. Refer to A7.5 for definition of other control variables. Robust *t*-statistics are reported in parentheses.

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*T(d)*	*E*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	R^2
Panel A: Baker and Wurgler filtered data													
Mining Firms, N=857													
Pooled OLS	-0.001	(-0.47)	0.002	(0.18)	-0.001	(-0.14)	-0.045	(-1.30)	0.005	(1.13)	-0.230	(-5.94)	0.07
Fixed effects	-0.001	(-0.36)	-0.006	(-0.55)	-0.002	(-0.30)	-0.064	(-1.88)	0.005	(1.09)	-0.267	(-7.28)	0.35
Non-mining Firms N=2738													
Pooled OLS	-0.002	(-2.55)	-0.002	(-1.81)	0.012	(2.51)	0.005	(0.28)	0.004	(2.00)	-0.177	(-9.93)	0.06
Fixed effects	-0.004	(-2.41)	-0.001	(-0.97)	0.015	(3.67)	-0.013	(-0.71)	0.006	(2.86)	-0.191	(-11.46)	0.28
Panel B: Unfiltered data													
Mining Firms, N=1479													
Pooled OLS	-0.002	(-0.94)	-0.002	(-0.90)	-0.030	(-0.99)	0.080	(0.39)	-0.232	(-0.99)	0.375	(1.04)	0.05
Fixed effects	0.001	(0.26)	-0.002	(-1.02)	-0.142	(-0.73)	0.129	(0.54)	-0.369	(-0.99)	0.458	(1.10)	0.25
Non-mining Firms N=3460													
Pooled OLS	-0.002	(-4.06)	-0.016	(-4.08)	0.003	(1.35)	0.004	(0.96)	0.024	(3.91)	-0.709	(-14.98)	0.40
Fixed effects	-0.001	(-0.41)	-0.016	(-3.84)	0.003	(1.84)	0.003	(0.79)	0.028	(4.01)	-0.720	(-15.26)	0.50

A7.10: Future EFWAMB and Changes in leverage: All Filters (continued)

	$FEFWAMB_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		$\left(\frac{LT+ST}{A}\right)_{t-1}$		
Different Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*T(d)*	*e*	*t(e)*	*F*	*t(f)*	*g*	*t(g)*	R^2
Panel C: Four Standard Deviation filtered data													
Mining Firms, N=1400													
Pooled OLS	0.000	(0.23)	-0.003	(-0.41)	0.054	(1.15)	-0.023	(-2.80)	0.007	(1.25)	-0.307	(-1.86)	0.13
Fixed effects	0.004	(0.98)	-0.005	(-0.63)	0.058	(1.31)	-0.022	(-2.64)	0.004	(1.00)	-0.288	(-1.93)	0.30
Non-mining Firms, N=3281													
Pooled OLS	-0.004	(-4.13)	-0.004	(-1.67)	0.045	(1.21)	0.013	(0.58)	0.026	(4.66)	-0.643	(-7.17)	0.25
Fixed effects	-0.005	(-2.28)	-0.005	(-1.87)	0.053	(1.26)	0.008	(0.42)	0.025	(4.08	-0.671	(-8.25)	0.41

A-8.1: Determinants of Book Leverage and Liquidity Measures: All Filters

Fixed effects panel analysis of leverage with respect to the liquidity measures, market-to-book ratio, fixed assets, profitability, firm size cumulative net debt and net equity issues for all filters is conducted on the model below:

$$\left(\frac{LT+ST}{A}\right)_t = a + b(EFWAMB)^*_t + c\left(\frac{M}{B}\right)_{t-1} + d\left(\frac{PPE}{A}\right)_{t-1} + e\left(\frac{EBITDA}{A}\right)_{t-1} + fLog(S)_{t-1} + g(EqIs)_{t-1} + h(DbIs)_{t-1}$$
$$+ i(EFWAMB)^*_t * liquidity + j\left(\frac{M}{B}\right)_{t-1} * liquidity + k\left(\frac{PPE}{A}\right)_{t-1} * liquidity + l\left(\frac{EBITDA}{A}\right)_{t-1} * liquidity + m\log(S)_{t-1} * liquidity$$
$$+ n(EqIs)_{t-1} * liquidity + o(DbIs)_{t-1} * liquidity + u_t$$

Here, The intercept, a, is not reported in the panels below. Leverage is defined as, long-term debt + short-term debt over total assets. Market-to-book is defined in two ways: EFWAMB is the external finance weighted average market-to-book ratio. And the market-to-book ratio is defined as, total assets less book value of equity plus market value of equity over total assets. Tangibility is measured as the net property, plant and equipment/total assets. Profitability is earnings before interest, taxes and depreciation/total assets. And size is the natural logarithm of total revenue. Cumulative net equity issued is, $(EqIs,$ the net equity issued divided by total assets cumulated over all years preceding the current year and cumulative net debt issued is, $(DbIs,$ the net debt issued divided by total assets cumulated over all years preceding the current year (net debt issued is measured as the change in long term plus short term debt). The last variable reflects the liquidity measure coefficients where liquidity measures are defined in 3 ways: BAS is the natural logarithm of yearly average of spread, VO is the natural logarithm of average daily trading volume for the year and Zeros is the zero-return measure which is defined as the number of days with zero returns in the year divided by total trading days in the year. Robust t-statistics are in parenthesis[48].

[48] While not reported in the main appendix the values for BAS, VO and Zeros with t-statistics are reported here. For Baker and Wurgler (2002) filter: [BAS = 0.078 (1.91); VO = -0.051 (-1.79); and zeros = 0.135 (0.65)]. Unfiltered: [BAS = 1.522 (1.51); VO = -2.205 (-1.57); and zeros = 0.629 (3.57)]. Four standard deviation filter: [BAS = 0.121 (3.04); VO = -0.165 (2.77); and zeros = 0.202 (1.96)].

A-8.1: Determinants of Book Leverage and Liquidity Measures: All Filters (continued)

	$(EFWAMB)^*_t$		M/B_{t-1}		PPE/A_{t-1}		$EBITDA/A_{t-1}$		$Log(S)_{t-1}$		EqIS		DbIS		
Estimates	*b*	*t(b)*	*c*	*t(c)*	*d*	*t(d)*	*e*	*t(e)*	*f*	*t(f)*	*g*	*t(g)*	*h*	*t(h)*	R^2
Panel A: Baker Wurgler filter, N = 2,532															
Variables	0.006	(0.93)	-0.013	(-1.41)	-0.139	(-7.70)	-0.142	(-1.95)	0.030	(3.08)	-0.046	(-2.95)	0.455	(8.93)	0.56
BAS*Variable	0.004	(1.03)	-0.001	(-0.13)	-0.141	(-11.57)	-0.051	(-1.25)	-0.004	(-0.78)	-0.021	(-2.63)	0.181	(6.97)	
Variable	0.004	(0.61)	-0.028	(-7.66)	-0.067	(-5.62)	-0.105	(-1.14)	0.032	(3.73)	0.012	(0.74)	0.232	(2.94)	0.54
VO*Variable	-0.002	(-0.66)	0.008	(4.38)	0.072	(5.74)	0.027	(0.64)	0.003	(0.79)	-0.011	(-1.40)	-0.038	(-1.24)	
Variable	-0.013	(-3.15)	0.024	(1.13)	0.439	(15.06)	-0.452	(-6.66)	0.041	(2.57)	-0.130	(-3.75)	0.047	(0.44)	0.57
Zeros*variable	0.019	(2.42)	-0.052	(-1.68)	-0.428	(-12.90)	0.563	(8.84)	-0.006	(-0.25)	0.177	(4.25)	0.152	(1.13)	
Panel B : Unfiltered, N = 3,450															
Variables	0.013	(0.55)	0.034	(1.93)	-0.060	(-1.51)	0.059	(0.75)	-0.380	(-1.36)	-0.515	(-1.49)	-0.198	(-0.66)	0.50
BAS*Variable	0.008	(0.81)	0.032	(2.14)	-0.054	(-1.74)	0.042	(1.05)	-0.171	(-1.46)	-0.187	(-1.51)	-0.186	(-0.90)	
Variable	0.031	(1.07)	0.053	(1.09)	-0.165	(-1.60)	0.049	(2.04)	-0.605	(-1.43)	-0.446	(-1.51)	0.465	(1.87)	0.50
VO*Variable	-0.016	(-1.28)	-0.028	(-1.15)	0.119	(1.71)	-0.031	(-1.90)	0.261	(1.56)	0.162	(1.52)	-0.133	(-2.18)	
Variable	-0.021	(-1.13)	0.017	(0.78)	0.156	(2.95)	-0.406	(-3.20)	0.096	(6.64)	-0.011	(-0.77)	-0.035	(-0.50)	0.34
Zeros*variable	0.042	(1.44)	-0.024	(-0.83)	-0.163	(-2.66)	0.456	(3.14)	-0.068	(-3.34)	-0.002	(-0.14)	0.098	(0.99)	
Panel C: Four Standard Deviation filter, N = 3,434															
Variables	0.087	(4.00)	-0.014	(-0.87)	0.108	(1.31)	0.024	(1.02)	-0.004	(-0.32)	-0.015	(-2.39)	0.016	(3.39)	0.40
BAS*Variable	0.043	(3.87)	-0.002	(-0.23)	-0.001	(-0.02)	0.041	(3.80)	-0.018	(-2.54)	-0.005	(-3.29)	0.005	(1.55)	
Variable	0.073	(3.24)	-0.014	(-0.73)	0.096	(1.19)	-0.015	(-0.27)	-0.017	(-0.86)	-0.005	(-0.58)	0.016	(1.66)	0.39
VO*Variable	-0.030	(-2.91)	0.004	(0.39)	0.016	(0.34)	0.006	(0.23)	0.024	(2.71)	-0.002	(-0.74)	-0.004	(-1.31)	
Variable	0.014	(1.30)	-0.015	(-1.87)	0.301	(3.45)	-0.349	(-2.72)	0.056	(3.90)	-0.009	(-0.46)	0.018	(1.70)	0.37
Zeros*variable	0.001	(0.06)	0.009	(0.75)	-0.229	(-1.73)	0.371	(2.73)	-0.012	(-0.47)	0.009	(0.46)	-0.020	(-1.49)	